JOURNAL OF THE ROYAL HORTICULTURAL SOCIETY

Vol. LXXV Part 12

DECEMBER 1950

PAGE

The Secretary's Page 461

Wisley in December 463

Masters Memorial Lectures, 1950: The Origin and Improvement of Cultivated Plants. By M. B. Crane, F.R.S., A.L.S., V.M.H. Part II. *Illustrated* 465

The "Orto Botanico," Padua. By Hugh Farmar. *Illustrated* 475

Plant Collecting in the Mountains of Andalucia. By Vernon H. Heywood, B.Sc. Part II. *Illustrated* 478

The White Bougainvillaea. By R. O. Williams, O.B.E. *Illustrated* 485

Notes from Fellows:

Cuttings of Deciduous Conifers. By Miles Hadfield . 487

Rhinephyllum Broomii L. Bolus. Gordon Rowley. *Illustrated* 487

Eriobotrya japonica. Oliver E. P. Wyatt. *Illustrated* . 488

Plants to which Awards have been made in 1950:

Trees and Shrubs 489

Book Notes 490

Proceedings cv

Index cvi

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CONTENTS OF VOL. LXXV

PAGE

THE SECRETARY'S PAGE 1, 53, 81, 141, 169, 217, 257, 297, 337, 373, 421, 461
THE WISLEY WAR MEMORIAL 3
WISLEY GARDENS 3, 54, 85, 143, 173, 219, 258, 299, 339, 376, 422, 464
SHRUB ROSES. By G. S. Thomas. *Illustrated* 6
SUMMER AND AUTUMN FLOWERING SHRUBS. By F. P. Knight. *Illustrated* ... 12
FURTHER NOTES ON WORSLEYA PROCERA. By Major Albert Pam, O.B.E., M.A., F.L.S., V.M.H. 20
AMARYLLIS BELLADONNA AND NERINE BOWDENI. By N. K. Gould. *Illustrated* 21
A NEW GLORIOSA (*G. Verschuurii*). By Thomas Hoog 22
A TRIPLOID KNIPHOFIA. By E. K. Janaki Ammal, D.Sc. *Illustrated* 23
WISLEY TRIALS, 1949/1950 ..... 26, 78, 117, 251, 331, 406,
AWARDS TO PLANTS IN 1949/1950 ..... 43, 135, 254, 291, 334, 410, 453, 489
BOOK NOTES 45, 80, 136, 168, 211, 255, 295, 336, 366, 418, 455, 490
THE GARDEN IN WINTER. By Patrick M. Synge. *Illustrated* 57
THE BROAD MITE. By G. Fox-Wilson. *Illustrated* 69
NEW AND NOTEWORTHY PLANTS:
Nymphaea gigantea alba. By R. S. Trickett. *Illustrated* 75
AWARD OF GARDEN MERIT—LXXXIII, LXXXIV. *Illustrated* 76, 208
CAMELLIA AND MAGNOLIA CONFERENCE, 1950 83
NOTES ON A FEW PLANTS FROM S.E. TIBET. By George Taylor, D.Sc. *Illustrated* 87
THE PRODUCTION OF QUALITY IN APPLES. By Professor T. Wallace, C.B.E., M.C., D.Sc., F.R.I.C. *Illustrated* 91
NEW AND NOTEWORTHY PLANTS:
Calceolaria Darwinii. By Colonel F. C. Stern, O.B.E., M.C., F.L.S., V.M.H. *Illustrated* 106
ROSES AS FLOWERING SHRUBS. By J. Wilson. *Illustrated* 107
NOTES FROM FELLOWS 108, 156, 197, 235, 359, 397, 487
GREY BULB ROT OF TULIP. By W. C. Moore. *Illustrated* 113
THE PEAT GARDEN. By A. Evans. *Illustrated* 145
SOME CHILEAN PLANTS CULTIVATED IN BRITAIN. By G. W. Robinson. Part I. *Illustrated* 161
PRESENT-DAY PROBLEMS OF THE HORTICULTURAL INDUSTRY. By F. A. Secrett, C.B.E., F.L.S., V.M.H. *Illustrated* 175
CYCLAMEN PERSICUM. By F. Streeter, V.M.H. *Illustrated* 185
EUCALYPTUS IN THE BRITISH ISLES. By D. Martin. *Illustrated* 186
LILIUM SHERRIFFIAE, A NEW HIMALAYAN LILY. By W. T. Stearn. *Illustrated* 190
SOME SCENTED-LEAVED PLANTS. By A. D. B. Wood 192
LEAF SPOT DISEASE OF CINERARIA (*Senecio cruentus*) NEW TO GREAT BRITAIN. By D. E. Green, M.Sc., and M. Ann Hewlett, B.Sc. *Illustrated* 199
SOME CHILEAN PLANTS CULTIVATED IN BRITAIN. By G. W. Robinson. Part II 202
HERBACEOUS ROCK GARDEN PLANTS. SOME INTRODUCTIONS FROM THE HIMALAYA AND S.W. CHINA. By W. G. MacKenzie. *Illustrated* 221
BUD BLAST ON RHODODENDRONS AND AZALEAS. *Illustrated* 230
NOTES ON THE ROSA SPECIES AND HYBRIDS AT WISLEY. By Rona Hurst 232
BUDDLEIA ALTERNIFOLIA. By F. Hanger. *Illustrated* 235
SOME FAMOUS IRISH GARDENS. By G. S. Thomas. Part I. *Illustrated* 236
SOME CHILEAN PLANTS CULTIVATED IN BRITAIN. By G. W. Robinson. Part III 247
THE GARDENS AT BODNANT. By Lord Aberconway, C.B.E., LL.D., V.M.H. *Illustrated* 261
ORCHIDS FOR THE 'WEEK-END GARDENER.' By David F. Sander. *Illustrated* ... 269
SOME CHILEAN PLANTS CULTIVATED IN BRITAIN. By G. W. Robinson. Part IV 278
A PHYSIOLOGICAL BREAKDOWN IN TOMATOES CAUSED BY HIGH TEMPERATURES IN 1949. By Robert McKay 288
AN EXPEDITION TO NEPAL. By O. Polunin, M.A., F.L.S. *Illustrated* 302
SOME FAMOUS IRISH GARDENS. By G. S. Thomas. Illustrated. Part II ... 315
PEACOCK MORAEAS. By T. T. Barnard. *Illustrated* 323

PAGE

NINETY YEARS A GARDENER: CAPTAIN W. S. C. PINWILL OF TREHANE. By Rt. Rev. J. W. Hunkin, D.D., Bishop of Truro. *Illustrated* 326
BORDER CARNATIONS. By Montagu C. Allwood, F.L.S., V.M.H. *Illustrated* 341
THE COOKING OF VEGETABLES. By Monsieur J. Vincent 346
SOME NEW VIRUS DISEASES OF ORNAMENTAL PLANTS. By Kenneth M. Smith, D.Sc., F.R.S. *Illustrated* 350
AMATEUR PLANT HUNTING IN THE ANDES. By M. W. Spitta. *Illustrated* 354
HORTICULTURE IN SINGAPORE. By R. E. Holttum. *Illustrated* 363
THE HYBRIDIZING OF LILIES: AN AMATEUR'S APPROACH. By O. E. P. Wyatt, *Illustrated* 378
SHOW AURICULAS: THE EDGED VARIETIES OF THE FLORISTS. By George M. Taylor. *Illustrated* 386
PLANT REACTIONS TO CHEMICAL AND PHYSICAL CHANGES. By Dr. Louis E. Blanchard 390
VIOLAS. By J. Wilson. *Illustrated* 396
PUYA ALPESTRIS IN ITS NATIVE LAND. By W. Balfour Gourlay 399
NEPETA MUSSINII AND N. × FAASSENII. By William T. Stearn. *Illustrated* ... 403
OBITUARY—F. J. CHITTENDEN, O.B.E., F.L.S., V.M.H. 424
MASTERS MEMORIAL LECTURES, 1950: THE ORIGIN AND IMPROVEMENT OF CULTIVATED PLANTS. By M. B. Crane, F.R.S., A.L.S., V.M.H. Part I. *Illustrated* 427
INVEREWE: A GARDEN IN THE NORTH-WEST HIGHLANDS. By M. T. Sawyer. *Illustrated* 436
PLANT COLLECTING IN THE MOUNTAINS OF ANDALUCIA. By Vernon H. Heywood, B.Sc. Part I 444
MASTERS MEMORIAL LECTURES, 1950: THE ORIGIN AND IMPROVEMENT OF CULTIVATED PLANTS. By M. B. Crane, F.R.S., A.L.S., V.M.H. Part II. *Illustrated* 465
THE 'ORTO BOTANICO' PADUA. Hugh Farmar. *Illustrated* 475
PLANT COLLECTING IN THE MOUNTAINS OF ANDALUCIA. By Vernon H. Heywood, B.Sc. Part II *Illustrated* 478
THE WHITE BOUGAINVILLAEA. By R. O. Williams, O.B.E. *Illustrated* 485

EXTRACTS FROM PROCEEDINGS:
GENERAL MEETINGS AND COMMITTEE REPORTS .....i, xxxv, xxxvii, lv, lxi, lxix, lxxvii, lxxxv, xcvii, cv
ANNUAL REPORT FOR 1949 xiii
BALANCE SHEET, 1949 xxv
ANNUAL GENERAL MEETING xli

INDEX cvi

NOTICE TO BINDER

Volume LXXV has been issued in twelve parts, consisting of the "Journal" proper, paged with Arabic figures, and "Extracts from the Proceedings," paged with Roman figures, in Parts 1–4, 6–9, 11 and 12. The title and contents should be placed first, and be followed by the twelve parts of the "Journal" proper, with the illustrations in the centre in each case, and then the ten parts of the "Extracts from the Proceedings."

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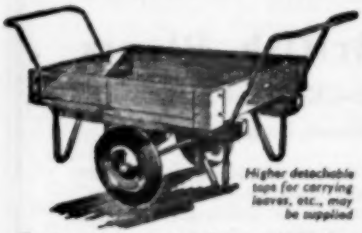

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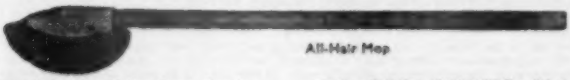

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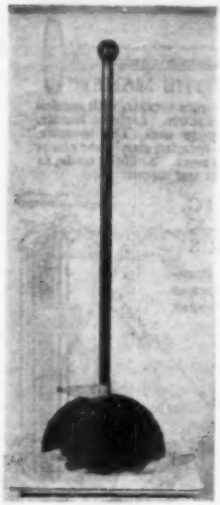

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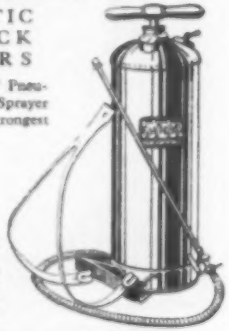

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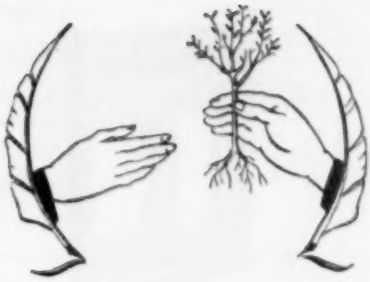

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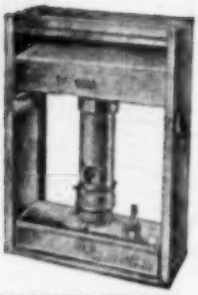

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Extracts from
THE PROCEEDINGS OF
THE ROYAL HORTICULTURAL SOCIETY

GENERAL MEETINGS

FRUIT AND VEGETABLE COMMITTEE—Mr. F. A. Secrett, C.B.E., F.L.S., V.M.H., in the Chair, and eleven other members present.

Awards Recommended:

Silver-gilt Knightian Medal

To the Hon. Mrs. G. Lane, Ashton Wold, Oundle, Northants., for a group of Vegetables.

Hogg Medal

To Messrs. Winkfield Manor Nurseries, Ascot, Berks., for a group of Apples and Pears.

Other Exhibits

Apple Seedling 'Cheal's No. 40' from Messrs. J. Cheal & Sons Ltd., Lowfield Nurseries, Crawley, Sussex.

Peach Seedling from H. E. North, Esq., 20 Durrants Drive, Croxley Green, Rickmansworth, Herts.

Apple Seedling from H. A. M. Vokes, Esq., 107 North East Road, Sholing, Southampton.

Apples 'Manning's Special' and 'Kinga' from H. L. Hawes, Esq., Hillside, Queens Park, Billericay, Essex.

Plum Seedling from Miss O. M. Chambers, Lested Lodge, Chart Sutton, Maidstone, Kent.

Group of Melons from The Director, Royal Horticultural Society's Gardens, Wisley.

Group of Cabbages from The Director, Royal Horticultural Society's Gardens, Wisley.

FLORAL COMMITTEE B—Lord Aberconway, C.B.E., LL.D., V.M.H., in the Chair, and fourteen other members present.

Awards Recommended:

Gold Medal

To Messrs. F. M. Wyatt and I. J. Ferguson Lees, of the Tilgate Horticultural Station, for an exhibit of cut branches of conifers, bearing cones.

Silver Banksian Medal

To Messrs. Haskins Bros. Ltd., Bournemouth, for an exhibit of Clematis and other flowering shrubs.

To Messrs. W. E. Th. Ingwersen, Ltd., East Grinstead, for an exhibit of dwarf shrubs and rock garden plants.

To Mr. F. Street, Woking, for an exhibit of hardy Heaths and conifers.

Flora Medal

To Messrs. Burkwood & Skipwith, Ltd., Kingston, for an exhibit of flowering shrubs.

To Mr. K. W. Harle, Lower Basildon, for an exhibit of succulents.

To Messrs. Robinson's Nurseries, Eltham, for an exhibit of rock garden plants.

To Messrs. L. R. Russell, Ltd., Windlesham, for an exhibit of Clematis and other flowering and foliage shrubs.

Banksian Medal

To Messrs. Kew Topiary Nurseries, Ltd., Richmond, for an exhibit of clipped trees.

To Messrs. Underwood Bros., Woking, for an exhibit of hardy Heaths.

Award of Merit

To *Clematis* 'Edward Prichard' (*heracleaefolia* × *recta*) as a hardy, herbaceous, flowering plant (votes unanimous), from Messrs. M. Prichard & Sons. Ltd., Christchurch.

To *Hydrangea villosa* as a hardy, flowering shrub (votes 10 for, 0 against), from W. Bentley, Esq., Quarry Wood, Burghclere, Newbury.

To *Rosa Moyesii* 'Geranium' as a hardy, ornamental-fruiting shrub (votes unanimous), from A. T. Johnson, Esq., Bulkeley Mill, Tyn-y-Groes, Conway.

Preliminary Commendation

To *Codonopsis* sp. nova, L. & S. 19620, as a hardy flowering plant (votes unanimous), from W. Bentley, Esq., Newbury.

Other Exhibits

Abies magnifica, exhibited by Colonel R. S. Clarke, M.P., Borde Hill, Haywards Heath, Sussex.

Rosa Sweginzowii, exhibited by A. T. Johnson, Esq., Bulkeley Mill, Tyn-y-Groes, Conway, N. Wales.

INDEX

R.H.S. JOURNAL, VOL. LXXV

References in Clarendon type are to the pages opposite which figures and illustrations will be found.

* Award given after trial at Wisley.
(a)—Azalea. (d)—Dutch. (e)—Early flowering.
(b)—Border (p)—Perpetual-flowering.

Abelia chinensis, exhb., vii
  Schumanii, 219
  triflora, **237**, 246
Abeliophyllum distichum, 56, 65, 320
Aberconway, Lord, C.B.E., LL.D., V.M.H., 76, 198, 261, 269
  on The Gardens at Bodnant, 261
Abies Alberti, 437
  amabilis, 240
  cephalonica, 244, xci
  concolor candicans, 246
    Wattezii, 240
  firma, xci
  Georgei, 240, 321
  grandis, 244, 321, xci
  Koreana, xci
  lasiocarpa, 197
  magnifica, cv, 237, 319
  nebrodensis, 481
  nobilis, 319
  numidica, xci
  Pindrow, 237
  Pinsapo, 480, 481, 482
  Veitchii, exhb., 321, xci, c
  Webbiana, 304, 312
Abutilon megapotamicum, **A.M.**, Sept. 6, 1949, exhb., iii, 43
  vitifolium, 165, 443
Acacia Baileyana, 4
  Cavenia, 203
  dealbata, 4, 245
  Drummondi, 4
  melanoxylon, 329
  platyptera, 377
Acaena argentea, 204
Acanthus latifolius, 438
Acarus translucens, 70
Accounts and Balance Sheets, xxvi
Acer Davidi, 58
  Forrestii, 149
  Goldsworth Purple, exhb., lxxxvii
  griseum, 58, 149, 155
  palmatum atropurpureum, 240
    Coral-bark Maple, **A.M.**, Feb. 14, 1950...334
    var. Senkaki, **A.M.**, exhb., lix
  platanoides Goldsworth Purple, **P.C.** exhb., xi
    Schwedleri, 241
  pseudoplatanus, **237**
    Leopoldii, 244
  reticulata, 246
  saccharinum, exhb., lxx
    laciniatum, 377
Achillea Moonlight, exhb., xcv
Aconitum Hookeri, exhb., xc
Actinidia chinensis, 318
Adenophora coelestis, 223
Adiantum venustum, exhb., lxxii
Adonis brevistyla, 222, **236**
Aesculus carnea, 435
  Hippocastanum, 435
  parviflora, 301, 377
  Pavia, 435
Agapanthus umbellatus, **440**
Agapetes macrantha, 4, 463
Aguas negras, 449
Ajuga, 55
Albizzia Julibrissin, 398
Allerton, F. A., on "Chrysanthemums for Amateur and Market Grower," reviewed, 336
Allium acuminatum, 221
  albopilosum, **A.M.** June 13, 1950, exhb., [xcii, 415
  amabile, 223
  atropurpureum, exhb., xci, xcii
  Beesianum, 223
  cyaneum, 223
  Farreri, 223
  Mairei, 223
  multibulbosum, exhb., xcii
  sikkimense, 223
  tuberosum, exhb., xii
  unifolium, Stolons in, exhb., lxxix
Allwood, Mr. Montague Charles, F.L.S., V.M.H., **67**
  on Border Carnations, 341
Aloe arborescens, 464
  aristata, 464
  brevifolia, 464
"Alpine Gardens, Miniature," by Helen G. Nussey, reviewed, 168
"Alpines, The Propagation of," by Lawrence D. Hills, reviewed, 491
Alpino, Prospero, 477
Alstroemeria aurantiaca, 259, 285
  aurea, 285
  chilensis, 285
  haemantha, 219, 284, 285
  Ligtu, 284
  peregrina, 284
  pulchella, 284
  pulchra, 284
  violacea, 219, 285
  × Walter Fleming, exhb., xcii
Alternaria senecionis, **193**, 201
× Amarcrinum Howardii, 339
Amaryllis Ackermannii, 320
  advena, 162, 285
  Belladonna, 21, **26**, 339, 341
    var. elata, exhb., iii
    Hathor, **F.C.C.**, exhb., iii
  cyrtanthoides, 285
  ignea, 285
Amaryllis Belladonna and Nerine Bowdeni, by N. K. Gould, 21

Amelanchier grandiflora rubescens, exhb., lxxii
Ammal, E. K. Janaki, D.Sc., on A Triploid Kniphofia, 23
Ampelopsis brevipedunculata var. Maximowiczii, exhb., xi
Amsler, Maurice, on Camellias for Roadside Planting, 235
Anagallis collina, 220
tenella, 451
"Anatomy of the Dicotyledons," by C. R. Metcalfe and L. Chalk, reviewed, 455
Anchor Plant, The, 19
Ancyclostemon, 225
Anderson, Mr., botanical collector, 163
André, E., 405
Androsace Aizoon, 223
alpina, exhb., xcvii
foliosa, 223
primuloides, 222
pyrenaica, **A.M.** April 4, 1950, exhb., lxxiii, 413
Selago, 223
sempervivoides, 222
spinulifera, 223
strigillosa, 223
Anemone angulosa, 149
angulosa nivea, 150
apennina, 144
blanda, 66
decapetala, 163
demissa, 222, **236**
glaucifolia, 339
Honorine Jobert, 405
hupehensis japonica, 405
× hybrid, 405
japonica, 405
magellanica, 163
nemorosa, 144, 150
var. Robinsoniana, 150
obtusiloba, 222
f. patula, 222
Pulsatilla, **193**, 440
var. Red Repose, exhb., lxxiii
rupicola, 222
tetrasepala, 440
vernalis, **A.M.** March 29, 1950...414
Anemonopsis macrophylla, 237
Angraecum distichum, 463
Anigozanthos flavida, 219
Annesley, Earl of, 187, 240
Annesley, Mr. Gerald F., 240
Annesley, Mr. R. Grove, 317, 318, 319
Annual General Meeting, 1, xlii
Report, 53
"Annuals," by Roy Hay, reviewed, 211
"Annuals, How to grow," by Ann Roes Robbins, reviewed, 216
Anthemis Cupaniana, 245
tinctoria Perry's variety, 259
Anthyllis cytisoides, 448
Tejedensis, 479
Antirrhinum, Advance, **H.C.*** July 18, 1949...123
Afterglow, 123
Amber Gem, 118
Queen, **H.C.*** July 18, 1949...119
Antirrhinum, Amor, 125
Aphrodite, **A.M.*** July 25, 1949...119
Apricot Beauty, 126
Queen, ***A.M.** July 18, 1949...118
Avalanche, **A.M.*** July 18, 1949...124
Beacon, **H.C.*** Aug. 4, 1949...121
Bedding Scarlet, 123
Black Prince, **H.C.*** July 18, 1949...119
Bonfire, **H.C.*** July 18, 1949...122
Burpee Double, **A.M.*** July 25, 1949, 126
Canary Yellow, **H.C.*** July 18, 1949, 118
Carmine Rose, **H.C.*** Aug. 4, 1949, 118
Charm, **H.C.*** July 18, 1949...120
Cherry Ripe, 122
C. H. Herbert, 125
Cottage Maid, **A.M.*** July 25, 1949, 120
Crimson Giant, **H.C.*** July 6, 1949, 126
King, 126
Velvet, **A.M.*** July 25, 1949...123
Dark Crimson, 119
Dazzler, 123
Delight, **A.M.*** July 18, 1949...124
Dorothy Silk, **A.M.*** Aug. 4, 1949, 122
Eclipse, **H.C.*** July 18, 1949...123
Eldorado, **H.C.*** July 25, 1949...124
Enchantress, 120
Evensong, **A.M.*** July 25, 1949...124
Fair Lady, 123
Fascination, 121
Feltham Beauty, **A.M.*** July 6, 1949, 125
Fiery Belt, 123
Fire Dragon, **H.C.*** July 18, 1949...125
King, 123
Flame, **H.C.*** July 18, 1949...123
Floradale Double, **A.M.*** July 25, 1949...126
Giant Skyscraper, 126
Glint of Gold, **H.C.*** July 18, 1949, 120
Gloria, **A.M.*** July 25, 1949...121
Golden Dawn, 125
Gem, 119
Queen, reselected, **H.C.*** July 25, 1949...119
Goliath, 125
Harmony, **H.C.*** July 18, 1949...121
His Excellency, **H.C.*** July 25, 1949, 123
Huntsman, 126
Intermediate Yellow, **H.C.*** July 18, 1949...119
Intermediate White, 119
Irmelin Rose, 120
Jaune Supreme, **H.C.*** July 18, 1949, 119
La Victoire, **H.C.*** July 18, 1949...122
Lemonade, **H.C.*** July 25, 1949...126
Luminant, 122
Magic Carpet, **H.C.*** July 6, 1949...118
Malmaison, **H.C.*** July, 25, 1949...121
Mauve Beauty, 122
Mefisto, 123

Antirrhinum, Monarch, 126
Nelrose, **H.C.*** July 25, 1949...121
Orange Glory, 125
Glow, **H.C.*** July 18, 1949...122
Rustproof, **A.M.*** Aug. 4, 1949, 117, 122
King, **H.C.*** Aug. 4, 1949...125
Scarlet, 119
Supreme, 122
Picture, **A.M.*** July 18, 1949...120
Pierette, 126
Pinkie, **H.C.*** July 25, 1949...118
Prima Donna, **H.C.*** July 18, 1949...120
Princess Elizabeth, 126
Psyche, 120
Purple King, **A.M.*** July 6, 1949...125
Queen of the North, 120
Radiance, **H.C.*** July 6, 1949...122
Red Chief, **H.C.*** July 25, 1949...125
Emperor, **H.C.*** July 18, 1949...123
Rocket, 123
Rich Rose, 118
Rosamond, 124
Rose Dore, **H.C.*** July 6, 1949...121
Eclipse, **A.M.*** July 25, 1949...121
Fairy, 126
Marie, 124
Princess, **A.M.*** July 6, 1949...124
Sensation, 121
Rosella Improved, 124
Roseum Superbum, **A.M.*** July 25, 1949...120
Royal Rose, **H.C.*** July 25, 1949...121
Rust Disease of (Puccinia antirrhini), 117
Resitant Pink, **A.M.*** Aug. 4, 1949, 117, 120
St. George, 122
Scarlet Triumph, **H.C.*** July 25, 1949, Supreme, 123 [123
Snowflake, **H.C.*** July 18, 1949...118
Splendour, **H.C.*** July 8, 1949...124
Startler, **H.C.*** July 25, 1949...125
Strawberry Gleam, **H.C.*** July 25, 1949...122
Sunset, **A.M.*** July 18, 1949...124
Tetra Mixed, 126
Tetraploid Mixed, 126
Twilight, **H.C.*** Aug. 4, 1949...124
Vesuvius, **H.C.*** July 18, 1949...123
Victory, **A.M.*** July 25, 1949...122
Welcome, **A.M.*** July 25, 1949...123
White Reselected, **A.M.*** July 16, 1949, 118
Queen, **H.C.*** July 6, 1949...119
Wonder, 119
Wisley Bridesmaid, **A.M.*** July 18, 1949...118, 120
Cheerful, **A.M.*** July 25, 1949...118, 121
Golden Fleece, **A.M.*** July 25, 1949, 118, 119
Yellow Beauty, **A.M.*** July 25, 1949...119
King, 125
Antirrhinum Trials at Wisley, **111,** 117
"Anzucht und Kultur der Bromeliaceen mit besonderer Berücksichtigung der für den Handel wichtigsten Arten," by W. Richter, reviewed, 457
Aphis fabae, 352
Aphyllanthes monspeliensis, 316, 447
Apple, Allington Pippin, 92
Andrew Johnson, exhib. v
Beauty of Bath, 466
Belle de Boskoop, 431
Bismarck, 92
Blenheim Orange, 431
Bramley's Seedling, 92, 431
Clifford Harding, exhb., x
Cox's Orange Pippin, 92, 466
Edward VII, 95
Ellison's Orange, **441**
England's Wonder, exhb., xxxv
Evargil, exhb., xxxv
Galloway Pippin, exhb., xxxv
Goodwin's Russet, exhb., xl
Grain's Ideal, exhb., xl
Gravenstein, 431
Hambledon Deux Ans, exhb., c
Herbert's Seedling, exhb., lxxix
Howgate Wonder, ix
Kinga, exhb., cv
Lane's Prince Albert, 92
Laxton's Royalty, exhb., xl
Manning's Special, exhb., cv
Marian Seymour, exhb., xl
Mary Hamilton, exhb., x
Monarch, 92
New Hybrid No. 21, exhb., x
Newton Wonder, 92, 95
Northern Spy, 466, 473
Queen Caroline, exhb., xxxv
Red King, exhb., i
Reinette du Canada, 431
Ribston Pippin, 431
Rootstock Malling No. 1, 92
No. V, 92
No. IX, 93
Seedling, exhb., i, vi, ix, x, xxxv, xxxvii, xl, xli, lxiv, cv
Cheal's No. 40, exhb., cv
No. 2 (James Grieve × Worcester Pearmain), exhb., i
No. 11 (Langley Pippin × James Grieve), exhb., i
No. 13 (Langley Pippin × James Grieve), exhb., i
No. 15 (Langley Pippin × Worcester Pearmain), exhb., i
Soutermere, exhb., xl
Sunset, exhb., vi
Worcester Pearmain, 92, **441**
Apples, Production of Quality in, The, by Prof. T. Wallace, C.B.E., M.C., D.Sc., F.R.I.C., 91, **110, 111,** 168
Aquilegia flabellata, exhb., lxxix
Arabis petraea, 420
Aranda Alastair (A. Hookeriana × V. limbata), **355**
Araucaria Bidwillii, 358
Cunninghamii, **244**
imbricata, 162
Arbutus Menziesii, 239
Unedo, **20**
rubra, exhb., xxxviii
Arctostaphylos Manzanita, 149
media, 152
pumila, 152

Ardilaun, Lady, 320
Arenaria armerina, 447
var. elongata, 452, 480
tetraquetra, 447, 449
var. frigida, 452, 477
Argylia canescens, 281
Arisaema sp. from S.E. Tibet, 89
candidissimum, 219
erubescens, 321
Aristotelia Macqui, 355
racemosa, 442
Armeria plantaginea, exhb., lxxxvii
Armytage-Moore, Mr., 17
Arnold-Forster, W., 189
on Myrtus Lechleriana, 360
Artemisia abrotanum, 194
Ludoviciana, 259
pedemontana, 194
pyramidalis, 320
Stellariana, 194, 320
Arthrotaxis, 246
cupressoides, 321
Arundaria nitida, 441
Asparagus, Bulletin of Ministry of Agriculture No. 60...491
Aster acris, 301, 340
Amellus, 301
Sonia, 340
Amy, **A.M.** Sept. 27, 1949...26
Biettii, 223
Coventry Pink, exhb., xi
Purple, exhb., xi
diplostephioides, 223
Forrestii, 223, 320
× Frikarti, 340
Jean, **H.C.** Sept. 27, 1949...27
Joker, **F.C.C.** Sept. 27, 1949...27
likiangensis 223
Mauve Beauty, **A.M.** Sept. 27, 1949, 26
Mrs. A. E. Underdown, **A.M.** Sept. 27, 1949...26
Pappei, 377
Purdomii, 223
Ronald, **A.M.** Sept. 27, 1949...27
Susan, **H.C.** Sept. 27, 1949...27
Vokes Pink, **A.M.** Sept. 27, 1949, 27
Asteranthera ovata, 280
Asters, Perennial, at Wisley, 1949...26
Astilbe simplicifolia, 154
Astragalus spp., 449
Asyneuma Lycium, exhb., lxxviii
Athrotaxis selaginoides, xxxix
Atkins, F. C., "Mushroom Growing Today," reviewed, 456
Auricula Lady Duresbury, 397
Auriculas, Show: The Edged varieties of the Florists, by George M. Taylor, 386, 396
Award of Garden Merit, 76
Azalea indica, 441
Azara Browneae, 165
var. variegata, 165
dentata, 165
Gilliesii, 165
integrifolia, 165
lanceolata, 165, 355
microphylla, 165, 237, 330, 355
Baccharis patagonica, 249
"Baccy: Grow and smoke your own," by Charles Wyse-Gardner, reviewed, 51
"Bacterial Plant Diseases, Manual of," by W. J. Dowson, reviewed, 211
Bailey, L. H., 22, 197
Baker, G. P., 157
Balbisia verticillata, 167
Balfour, James M., 186
Ballard, Ernest, V.M.H., xxii, 67
Ballou, H. A., 486
Bambusa fastuosa, exhb., lxxxvii
Metake, exhb., lxxxvii
nigra, exhb., lxxxvii
Banks, Sir Joseph, 70, 206
Barbaro, Daniele, 476
Barnard, T. T., on Peacock Moreseas, 323
Bartlett, Dr. K., 486
Mr., 275
Bateman, Mr. 188
Bawden, F. C., on "Plant Viruses and Virus Diseases," reviewed, 455
Bean, Mr., 77, 203, 209
Bean, W. J., C.V.O., I.S.O., V.M.H., on "Trees and Shrubs hardy in the British Isles," reviewed, 366
Bean, Dwarf French, Black Wonder, 37
Bounteous, 37
Delight, 37
Dutch Princess, 36
Early Giant, 37
Flight, 37
Masterpiece, 37
Improved, **F.C.C.*** July 27, 1949...37
Merton, 36
Peerless, 37
Premier, 37
Ranger, 37
Tendergreen, 37
Tenderpod, 37
The Prince, **A.M.*** July 27, 1949, 37
The Wonder, **H.C.*** July 27, 1949, 37
Runner, Best of All, 38
Cobham Park, 38
Goliath, **A.M.*** Sept. 12, 1949,...38
Kingsbrook Monarch, **A.M.*** Sept. 12, 1949...38
Osmaston Giant, **H.C.*** Sept. 12, 1949...38
Prizewinner, **A.M.*** Sept. 12, 1949, 38
Streamline, **H.C.*** Sept. 12, 1949, 38
Bean Seed Fly (Delia cilicrura) attacking Gladiolus, exhb., xciv
Beans, Dwarf French at Wisley, 1949...36
Beans, Runner at Wisley, 1949...37
Beddall, J. L. on "Hedges for Farm and Garden," reviewed, 295
Beet, Cheltenham Green Top, 40
Reselected, 40
Vigour No. 10, **H.C.*** Oct. 12, 1949, 39
Cobham Early, **H.C.*** July 20, 1949...39
Crimson King, 39
Crosby, 39
Crosby's Asco, 39
Deep Blood Red Globe, 39

Beet, Detroit, 39
Asco, **A.M.*** July 20, 1949—38
Dark Red, **A.M.*** July 20, 1949—38, 39
Short Top, 39
Deventer Black Leaf, 40
Dobbie's Purple, 40
Dutch Market, 40
Early Wonder, 39
Perfection Globe, 39
Empire Globe, **A.M.** July 20, 1949—39
Exhibition Black, 40
Feltham Globe, **A.M.*** July 20, 1949, 39
Ferry's Strain, 39
Fireball, 39
Garden, Best of All, 40
Good-for-All, **H.C.*** July 20, 1949—39
Green Top Bunching, **A.M.*** July 20, 1949—39
Early Wonder, 39
Intermediate or Obelisk, 39
Light-Leaved, 40
Long Dutch, 40
Market King, 40
Non-Bleeding, **H.C.*** Oct. 12, 1949, 39
Obelisk, **A.M.*** July 20, 1949—39
Perfected Detroit, 39
Pragnell's Exhibition, 40
Red Selected, 40
Regar Exhibition Selected, 40
Seakale, Fordhook Giant, exhb., xcvii
Summer Globe, **H.C.*** July 20, 1949, 39
Sutton's Black, **H.C.*** Oct. 12, 1949, 40
Blood Red, 40
Globe, 39
Greentop, **A.M.*** Oct. 12, 1949—39
Beet, Garden, at Wisley, 1949—38
Begonia disease, 73
Gustav Hind, 339
Rust, 69
Semperflorens, 339
Shirley Desire, **A.M.** July 11, 1950, exhb., xcviii, 415
"Begonia, The Tuberous, its Development and Culture," by Allan G. Langdon, reviewed, 47
Berberidopsis corallina, 164, 437
Berberis buxifolia, 163, 355
var. nana, 163
chillanensis, 164
var. hirsutipes, 164
Chitria, 423
congestiflora, 164
crispa, 164
Darwinii, 163, 164, 173, 354, 355
empetrifolia, 163, 173
fascicularis, 209
hakeoides, 163
Jamesiana, 423
linearifolia, 163, 164, 355
lologensis, exhb., lxxii, 164, 355
montana, **155**, 164, 173
sp., exhb., xciii
sp. YÜ 14938, exhb., lxxii
stenophylla, 163, 173
Berberis Thunbergii atropurpurea, 15
valdiviana, 164
vernae, 173
verruculosa, 173, 423
virescens, 423
Bergenia ciliata, 316
cordifolia, 85
crassifolia, 150
ligulata, 149
Berry, G. H., on Forms or Hybrids, 110
Betula papyrifera, 239
utilis, 149, 246
verrucosa dalecarlica, 240
Bewley & White, Messrs., 288, 290, 291
Bignonia grandiflora, 18
Billardiera longifolia, 437
"Biological Journals, A list of Abbreviations of the Titles of," reviewed, 140
"Biology, an Introduction to Medical and other Studies," by P. D. F. Murray, M.A., D.Sc., reviewed, 459
Bipinnula mystacinica, 282
Birbeck, Robert, 187
Blackberry, Denver Thornless, selected for trial, vi
Blanchard, Dr. Louis E., on Plant Reactions to Chemical and Physical Changes, 390
Blandfordia marginata, exhb., xcvi
"Blomster Dyrking Under Glass," by Prof. Anne Thorsrud, reviewed, 47
Blumenbachia insignis, 207
Blunt, Wilfrid, on "The Art of Botanical Illustration," reviewed, 366
Blythe, Thomas, 237
Bodnant, The Gardens at, by Lord Aberconway, C.B.E., LL.D., V.M.H., 261, **276**, **277**
Boegschoten, H., 361
Bolus, Mrs., 325, 488
Bomarea salsilla, 285
Bonafede, Francesco, 476
Book Notes, 45, 80, 136, 168
Boscawen, The Hon. John Townshend, 327
"Botanical Illustration, The Art of," by Wilfrid Blunt, reviewed, 366
Botanical Magazine, The, 2, 76, 77, 78,
"Botanik der Gegenwart und Vorzeit in culturhistorischer Entwickelung: ein Beitrag zur Geschichte der abendländischen Völker," by Karl F. W. Jessen, reviewed, 213
"Botany for Gardeners," by R. P. Faulkner, reviewed, 48
"Botany, an Introduction to," by J. H. Priestley and Lorna I Scott, reviewed, 419
Bougainvillaea glabra Cypheri, exhb., cii
Bougainvillaea, The White, by R. O. Williams, O.B.E., **477**, 485
"Bouquet," by G. S. Whittet, reviewed, 214
Bouvardia Bridesmaid, 429
Hogarth, 429
Bowes-Lyon, The Hon. David, 261
Bowles, Mr. E. A., V.M.H., 62, 63, 264
Brachyglottis repanda, 245
Brassia verrucosa, **C.C.**, exhb., xciii

Brassica oleracea, 435
rapa, 435
rapa-oleracea, 435
Brassocattleya Juno (C. Titrianae × Bc. × Olympic), **A.M.** April 4, 1950, exhb., lxxiii, 292
Brassolaeliocattleya Midinette, **A.M.** Oct. 18, 1949, exhb., xii, 45
Brenchley Winifred E., and H. C. Long on "Suppression of Weeds by Fertilizers and Chemicals," reviewed, 372
Brett, R. G., 189
Bridges, Thomas, Esq., 282
Briggsia, sp., 225
Broad Mite, The, by G. Fox Wilson, **67**, 69
Brodiaea ixioides, 286
uniflora, exhb., lxx
Brown, F. C., 74
Brown, N. E., 202, 488
Bruckenthalia spiculifolia, 154
Brunfelsia undulata, 339
Bryocarpum himalaicum, 229
Bryophyllum Daigremontianum, 464
Buddleia alternifolia 220, 235, **236**
auriculata, 442
Colvillei, 246, 316, 328
Davidi, 13, 17, 301, 353, **355**
Fromow's Purple, 17
Ile de France, 17
Purple Splendour, exhb., cii
Royal Red, **A.M.** Aug. 1, 1950, exhb., cii, 17, 489
Splendour, exhb., iii
Fallowiana var. alba, 17
globosa, 250, 356, 357
madagascariensis, 463
variabilis = B. Davidi
veitchiana, 328
Buddleia alternifolia, by F. Hanger, 235
Bulbophyllum tremulum, 270
Bulbs, Awards to, 44
Bunge, C. J., 361
Bupleurum spinosum, 382
Burkhill, Mr., 302
Burning Bush, 77
Bury, Lord, 241
Bush, Raymond, "A Fruit Grower's Diary," reviewed, 456
Buxus sempervirens, 451

"Cactus Grower's Guide, The," by Vera Higgins, reviewed, 369
Cactus speciosissimus, 271
Cajophora laterita, 207
Calampelis scaber, 281
Calandrinia discolor, 165
grandiflora, 165
Calanthe Harrisii, 463
rosea, 463
Veitchii, 463
vestita, 463
Calceolaria Pavonii, 339
picta, 400
polyrrhiza, 356
violacea, 242, 329, 440
Calceolaria Darwinii, by F. C. Stern, F.L.S., V.M.H., 106, **110**
Calceolarias, 161
Calendula suffruticosa, 340
Callicore rosea, 21
Callistemon citrinus, 219
splendens, exhb., lxv
pallidus, exhb., xciii
speciosus, 329, 464
Calluna Hammondii, 19, 259
J. H. Hamilton, 19
vulgaris, 154
Alportii, 19, 259, 376
H. E. Beale, 19, 340
Caltha palustris, 174
Calydorea speciosa, 284
Camellia, × Donation, 398
japonica, exhb., lxxi, lxii, 67, 76, 85, 144, 235, 267
Adolphe Audusson, 67, 464
Anemoniflora, **A.M.** March 7, 1950, exhb., lxii, lxiii
Donckelari, exhb., lxiii
elegans, 67
Lady Clare, 67, 329
var. magnoliaeflora, 464
Pink Pearl, **A.M.** May 5, 1950, exhb., lxxxi, 334
varieties, exhb., lxv
White Swan, 4, 67, 464
oleifera, 67
reticulata, 67, 86, 235, 242, 329
Trewithen Pink, **A.M.** April 4, 1950, exhb., lxxi, 334
saluenensis, exhb., lix, 67, 76, 86, 267
Sasanqua, 67
fragrans, 377, 464
× Williamsii, 67, 86, 267, **277**
Williamsii var. J. C. Williams, 76, 86
Mary Christian, 86
Camellia and Magnolia Conference, 1950...83
Camellias, A simple method of Propagating, by Collingwood Ingram, 397
Camellias for Roadside Planting, by Collingwood Ingram, 158
Camellias for Roadside Planting, by Maurice Amsler, 235
Campanula alsinoides, 260
argyrotricha, 223
bellidifolia, 440
cashmiriana, 223
garganica var. fenestrellata, **A.M.** June 27, 1950, exhb., xcvii
haylodgensis, 260
hercegovina var. nana, **A.M.** 1946, exhb., xcvii
isophylla Mayi, 339
lactiflora, 259
latifolia alba, 259
mollis var. 481, 482
var. giennensis, 452
pelia, **A.M.** May 23, 1950, exhb., xc
persicifolia Windsor Belle, selected for trial, exhb., xcv
pilosa var. dasyantha, **A.M.** April 25, 1950, exhb., lxviii, 414
specularioides, 480
Campsis chinensis, 18

Campsis grandiflora, **A.M.** Sept. 6, 1949, exhb., iii, 18, 43, 299
radicans, 18
Tagliabuana, (grandiflora × radicans), **P.C.** exhb., iii, 299
Capsid Bub (Lygus pabulinus) attacking Magnolia, exhb., xciv
Carex scaposa, exhb., xi
Carey, Dr. William, 362
Carnation (b) A. A. Sanders, 29
(p) Allwood's Golden Glory, **A.M.** May 23, 1950, exhb., xxxix, lxxxix, 417
(p) Allwood's Market Pelargonium, exhb., xxxix
(p) Allwood's Prolific, exhb., xxxix, lxxxix
(b) Apricot Bizarre, **H.C.*** July 8, 1949, 28
Bennie Fancy, exhb., cii
(b) Betty Prescott, 29
Bizarres, **354**
(b) Bookham Favourite, 29
(p) Brumas, exhb., lxxv
(b) Cherry Flake, 28
(b) Cottage Apricot, 27
(b) Cottage Claret, 28
(b) Cottage Gem, 28
(b) Cottage Jewel, 29
(b) Cottage Primrose, 27
(b) Cottage Rose, 27
(b) Cottage Ruby, 28
(b) Cottage Salmon, exhb., selected for trial, xcv
(b) Cottage Triumph, exhb., selected for trial, xcv
(b) Cottage Vivid, 28
(b) Cottage Wonder, 27
(b) Crimson Frills, 29
(b) Crimson Model, **A.M.*** July 14, 1949...28
(b) David Douglas, **H.C.*** July 14, 1949...29
(b) Dawn Glory, **C.*** July 8, 1949, [29
(b) Diplomat, 28
(b) Downs Beauty, 28
(b) Downs Cerise, **H.C.*** July 14, 1949, 28
(b) Downs Clove, exhb., selected for trial, xcix
(b) Downs Flame, exhb., selected for trial, xcv
(b) Downs Glory, **H.C.*** July 8, 1949, 28
(b) Downs Pink, exhb., selected for trial, xcix
(b) Downs Sunset, **C.*** July 14, 1949, 28
(b) Dusky Maid, exhb., selected for trial, c
(b) Edenside White, 27
(b) Elegance, exhb., xcix
(b) Eva Humphries, **H.C.*** July 14, 1949...29
Fancy Border, 354
(b) Fancy Monarch, 28
(b) Frances Sellars, 27
(b) Friendship, **H.C.*** July 14, 1949, 29
(b) Gavotte, exhb., selected for trial, c
Carnation (b) Greyling, exhb., selected for trial, xcix
(b) Heartsease, 29
(b) Indomitable, **H.C.** July 14, 1949, 29
(b) Jean Frost, 28
(b) John Stobart, 29
(b) Katherine Mapes, exhb., xcix
(b) Lancing Lady, 29
(b) Liberty, 29
(b) Lotheredale, **A.M.** July 11, 1950, exhb., selected for trial, xcix, 417
(p) Market Pearl, exhb., lxxxix
(b) Milkmaid, exhb., xcix
(b) Perfection, 29
(b) Picotee Fascination, **A.M.*** July 8, 1949...29
Picotees, **354**
(b) Pierette, 29
(b) Pink Clove, 27
(b) Pink Pearl **A.M.*** July 14, 1949...27
Ramparts Red, exhb., xcv
(b) Rifleman, **354**
(b) Rose Frills, 29
(b) Royal Mail, **F.C.C.** July 18, 1950, exhb., c, 417
(b) Scarlet Emperor, exhb., selected for trial, xcix
(b) Seedling No. 29, exhb., xcix
(b) Spangle, 28
(b) Spencer Davies, 27
(b) Sprite, **H.C.*** July 8, 1949...28
(b) Sunbeam, **H.C.*** July 14, 1949...29
(b) Sunstar, **A.M.** July 18, 1950, exhb., selected for trial, c, 417
Thornton Scarlet, exhb., xcviii
Thornton Yellow, exhb., xcviii
(b) Togo, 29
(b) Thomas Lee, **A.M.*** July 14, 1949, 29
(b) Waternymph, exhb., selected for trial, c
(b) W. B. Cranfield, **F.C.C.*** July 14, 1949...28
(b) William Newell, **F.C.C.*** July 8, 1949...28
Carnations, Border, at Wisley, 1949...27
Carnations, Border, by Montague C. Allwood, F.L.S., V.M.H., 341
Carnations Border Selfs, 354
Carpentaria californica, 320
Carpenter, C. W., 70, 73
Caryopteris clandonensis, 13, 340
Cassia Closiana, 203
corymbosa, 377, 438
coquimbensis, 398
stipulacea, 203
Cassiope fastigiata, 89, 152, 309
lycopodioides, 152
Mertensiana, 152
pectinata, 89
selaginoides, 89, 110
tetragona, 152
Wardii, **A.M.** May 3, 1949...89, 90, **110**
Catalpa bignonioides, 15
Catanache coerulea, 450
Cattleya, Bow Bells var. Snowdrop, **A.M.** Oct. 18, 1949., exhb., xii, 45
labiata, 269

Ceanothus austromontanus, 245
Autumnal Blue, 18
Burkwoodii, 18, 438, 440
Gloire de Versailles, 13, 18, 27, 340
Henri Defosse, 18
Perle Rose, 18
Topaz, 18
Veitchianus, 358
Cedrus atlantica glauca, 57
pendula, 315
Celery, Variegation in, v
Centaurea chilensis, 249
Clementei, 480, 481
Clementinae, 320
Cephalotaxus, sp., 240
Ceratostigma plumbaginoides, 299, 340
Willmottianum, 13, 17, 340, 440
Cercidiphyllum japonicum, 246
magnificum, 155
Cereus chilensis El Quisco, 207
Ceropegia Woodii, exhb., lvii
Cestrum aurantiacum, 339, 423, 463
elegans, 438
glaucum, 251
japonica magnoliaeflora, 423
Parqui, 251
purpureum Smithii, 423
Chaenomeles japonica, 65
Choshan, exhb., lxxii
Rowallane Seedling, exhb., lxxii
lagenaria, 65
Rowallane Seedling, 238
Chaenorrhinum glareosum, 478
Chalk, L., and C. R. Metcalfe, "Anatomy of the Dicotyledons," reviewed, 455
Chamaepeuce hispanica, 450
Chamaerops excelsa, 440, 441
Chandler and Booth's Monograph of Camellia Japonica varieties, 85
Chelsea Show, 1950...170, 316
"Chemistry of Insecticides, Fungicides and Herbicides," by Donald E. H. Frear, Ph.D., reviewed, 214
Chilean Plants, Some, cultivated in Britain, by G. W. Robinson, 161, 202, 247
Chimonanthus praecox (fragrans), 60
var. luteus (Wintersweet), exhb., lviii, 5, 56, 60
Chionodoxa Luciliae, 85
gigantea, 150
× Chionoscilla Allenii, 86
Chirita, sp., 225
Chittenden, Frederick James, O.B.E., F.L.S., V.M.H., by E. A. Bowles, 424.
Chloraea aurantiaca, 282 [440
disoides, 282
leontoglossa (grandiflora), 358
longebracteata, 282
multiflora, 282
Chrysanthemum Adoration, exhb., selected for trial, lx
Aladdin's Lamp, **A.M.**° Oct. 25, 1949, [79
(c) Alfreton Ivory, 127
(c) Alfreton Yellow, **A.M.** 1947...128
(c) Alfreton Yeoman, **A.M.**° Sept. 7, 1949...130
(c) Alpine, 127
Alice Brown, exhb., selected for trial, v
Chrysanthemum Amber Daydream, exhb., selected for trial, xi
Anne, 79
(c) Anson, 129
(c) Apricot Sweetheart, **A.M.** 1949, exhb., ciii
Arthur Ward, **A.M.** 1949, exhb., iv, v
Attractive, exhb., ix
(c) August Beauty, exhb., selected for trial, ciii
Avocet, exhb., v
Azaleanum, **A.M.**° Sept. 27, 1949...79
(c) Barbara, **F.C.C.** 1947...iv, 129
Betty Ross, **H.C.**° Oct. 25, 1949...79
(c) Blenheim Gem...130
Bonnie, exhb., selected for trial, iv
Brabazon, exhb., selected for trial, xi
Bracken, **H.C.**° Oct. 25, 1949...78
Bravado, **A.M.** exhb., selected for trial, viii
(c) Bridesmaid, **A.M.** 1943...128
Bronze Amber Vale, exhb., selected for trial, v
(c) Bronze Barbara, 129
(c) Bronze Christine, exhb., ciii
Bronze Duchess, exhb., v
(c) Bronze Marie, syn. Bronze Dallas, **A.M.**° Aug. 19, 1949...129
(c) Bronze McLeod, 129
(c) Bronze Sweetheart, exhb., ciii
(c) Bronze Una, exhb., v, 129
Bryan Alway, exhb., ix
Burpham, exhb., selected for trial, v
Caliph, **A.M.**° Oct. 25, 1949...80
Cambria, **A.M.** Nov. 1, 1949, exhb., xxxviii, 135
Capable, **A.M.** exhb., selected for trial, v
(c) Carol, **F.C.C.** 1948, exhb., ciii, 129
Carlotta, exhb., v, viii
Cascade, exhb., xxxviii
(c) Cavalier, **A.M.**° Aug. 19, 1949...129
(c) Challenger, 129
Chanceller, exhb., selected for trial, v
Charm, exhb., xxxviii
Charming Maid, exhb., selected for trial, v
Chas. E. Morris, exhb., iv
Chatsworth, **A.M.** Sept. 6, 1949, exhb., selected for trial, iv
Cherry Red, 79
(c) Choice, 129
Cinnamon, exhb., v
Conqueror, exhb., viii
(c) Coppelia, **A.M.** 1940...129
Copper Rose, 79
Corncob, **A.M.** Sept. 13, 1949, exhb., selected for trial, iv, v
(c) Cotswold Gem, **A.M.**° Sept. 7, 1949. **F.C.C.** Aug. 15, 1950, exhb., ciii, 127, 453
Cream Youth, exhb., selected for trial, v
(c) Cresset, exhb., selected for trial, xi, 129
Crimson Bronze Barbara, exhb., viii
(c) Crimson Wonder, 130
Dainty, exhb., ix
Dark Orchid Queen, exhb., ii

Chrysanthemum (e) Day Dream, **A.M.**° Sept. 7, 1949...128
(e) Deep Red Sweetheart, **A.M.** Aug. 1, 1950, exhb., selected for trial, cii
Delicacy, **A.M.** 1949, exhb., iv, v
Derby Day, **H.C.**° Oct. 25, 1949...79
(e) Dollars, 128
Doris, exhb., selected for trial, viii
Dorothy Wearing, **A.M.** 1949, exhb., selected for trial, v, viii
Dreamer, exhb., v
(e) Edensor, **A.M.** 1947, exhb., ciii
(e) Egerton Sweetheart, **A.M.** 1945, exhb., ciii
Elysia, exhb., ix
(e) Empress, 129
(e) Fair Maid, **F.C.C.**° Aug. 19, 1949, 127
Ffrida, 79
Flame, **H.C.**° Oct. 25, 1949...80
(e) Flavius, **A.M.** 1947...128
(e) Fondant, 129
Foremost, **A.M.** Aug. 15, 1950, exhb., selected for trial, ciii
Frances Drake, exhb., ix
Francis, **H.C.** Oct. 25, 1949...79
Freda Perry, exhb., xl
Fuchsine, 79
(e) Gladiator, **F.C.C.** 1944...130
Gladys Case, exhb., selected for trial, iv, v
Gloaming, **A.M.** exhb., selected for trial, viii, ix
Godfrey Baseley, exhb., ix
Gold Delight, exhb., v
Golden Arrow, 78
(e) Golden Crossley, 128
Golden Fragrance, 78
Golden Harvest, exhb., v, 128
Golden McLeod, exhb., selected for trial, iv
Golden Sceptre, **A.M.** exhb., selected for trial, v
(e) Golden Surprise, **A.M.**° Sept. 27, 1949...127
(e) Golden Sweetheart, **A.M.** Aug. 1, 1950, exhb., selected for trial, cii, 451
Golden Valley, exhb., ix
(e) Gold of Ophir, **A.M.**° Sept. 7, 1949, 127
(e) Goldenbloom, **A.M.** 1947...128
(e) Hallmark, **A.M.**° Sept. 7, 1949, 127
Happiness, exhb., v
(e) Hope Valley, **A.M.**° Aug. 19, 1949, 129
(e) Hurricane, **A.M.** 1945...130
(e) Hyde, **A.M.** 1947...128
Ice Cap, exhb., selected for trial, v
Incurved Edith Alston, **A.M.** Oct. 18, 1949, xxxvi, 135
(e) Incurved Zenith, 130
(e) Intense, 128
Jervis Bay, 79
J. J. Barnett, exhb., selected for trial, v
Joan, exhb., selected for trial, ix
John Wearing, exhb., xi
Julie, exhb., viii
Chrysanthemum J. W. Randall, exhb., ix
Lady Brocket, 79
(e) Lady Gay, 129
(e) Ladybower, **A.M.**° Aug. 19, 1949, 128
Ladylike, **A.M.** exhb., selected for trial, viii, ix
Leah's Green Glory, exhb., xl
Magic, exhb., v, 128
Margaret Clarke, exhb., xi
(e) Marion, 127
Mary Stoker, 78
(e) Mauve Princess, **A.M.**° Sept. 7, 1949...129
maximum Esther Read, exhb., xcv
maximum Jennifer Read, exhb., selected for trial, xcviii
(e) Mayford Orange, 129
(e) Mayford Pink, 129
(e) Merlin (e), 130
Merrydue, **A.M.** exhb., selected for trial, viii, ix
(e) Millersdale, **A.M.** 1946...127
Moira Goddard, 79
Muriel, exhb., ix
(e) New Crusader, 128
(e) No. 1 Pom, exhb., ciii
(e) Nymph, **A.M.**° Sept. 7, 1949...127
Old Golden, **H.C.**° Oct. 25, 1949...79
Oporto, 79
Orange Girl, exhb., xl
(e) Orange Lovelace, 128
(e) Orange Sweetheart, **F.C.C.** Aug. 1, 1950, exhb., cii, 453
Orange Torch, **A.M.** exhb., selected for trial, viii
Orchid, exhb., v
Parthenium fl. pl., exhb., xcviii
(e) Patricia, **A.M.**° Sept. 7, 1949...128
Peach Pink, 79
(e) Peach Sweetheart, **A.M.** 1949, exhb., ciii
(e) Peach Una **A.M.**° Sept. 27, 1949, 129
Peak Pearl, **A.M.** 1949, exhb., selected for trial, v
(e) Pearl Sweetheart, syn. Lily Lambert Sweetheart, **F.C.C.**° Aug. 19, 1949, exhb., ciii, 128
(e) Phase, **A.M.**° Sept. 27, 1949...127
Phillipine Green, 79
(e) Pink Una, 129
Pirate, **A.M.** 1949, exhb., selected for trial, iv, v
Polly Flinders, **A.M.**° Sept. 27, 1949, 79
praeteritum, exhb., xciii
Prefect, **A.M.** 1949, exhb., selected for selected for trial, v, viii
Prescilla, exhb., xl
Prim, exhb., selected for trial, iv
Prima Donna, **A.M.** 1949, exhb., trial, iv, v
Primo, **A.M.** 1949, exhb., selected for trial, iv
(e) Primrose Empire, **A.M.**° Sept. 27, 1949...127
Primrose Favourite, exhb., xl

Chrysanthemum Prince, **A.M.** 1949, exhb., selected for trial, iv, viii
Princess Margaret, 79
Queen Cushion, 78
(e) Radar, **F.C.C.** 1947...128
(e) Rearlight, **A.M.** Aug. 15, 1950, exhb., selected for trial, ciii, 453
Red Barbara, exhb., v
(e) Red Caesar, 130
Red Flare, **A.M.** 1949, exhb., selected for trial, viii
Red Lady, exhb., v
(e) Red McLeod, **A.M.*** Sept. 27, 1949...130
Red Warrior, exhb., xl
(e) Red Zenith, 130
(e) Revenge, 130
Reverie, exhb., viii
Roselight, exhb., v, 129
Rosevern, **A.M.** Sept. 27, 1949, exhb., selected for trial, viii, ix
Rotary, **A.M.** Nov. 29, 1949, exhb., xl, 135
(e) Rowsley, 130
Royal Amber, exhb., v
Royal Bronze, exhb., viii
Royal Copper, exhb., v
Royal Daffodil, exhb., selected for trial, ix
Royal Flame, exhb., selected for trial, iv
Royal Orange, exhb., viii
(e) Royal Pink, 129
Royal Sovereign, exhb., iv
Royal Supreme, exhb., viii
rubellum, 78, 340, 376
Rufus, exhb., viii
(e) Salmon Bronze, 129
Salmon Daydream, exhb., selected for trial, ix
(e) Salmon Lovelace, **A.M.*** Aug. 19, 1949...129
(e) Salmon Sweetheart, **A.M.** 1946, **F.C.C.** Aug. 1, 1950, exhb., cii, 453
(e) Salmon Una, 129
(e) Salmon Vernon, exhb., ciii
(e) Seedling B., exhb., ciii
(e) Seedling E., exhb., ciii
(e) Seedling I, **A.M.** Aug. 15, 1950, exhb., selected for trial, ciii
(e) Serenade, **A.M.** 1948, exhb., v, ciii
(e) Shell Bouquet, 128
(e) Shirley Cream, syn. Clifford Buckley, 127
Snow Glint, exhb., selected for trial, v
(e) Snow Queen, **A.M.*** Sept. 27, 1949, 127
Solferiono, 79
Spitfire, 79
(e) Sport from Radar, **A.M.** Aug. 15, exhb., selected for trial, ciii
Steadfast, **A.M.** 1949, exhb., selected for trial, iv, viii
Sunbrite, exhb., selected for trial, xi
(e) Sunshine, 128
(e) Swan, 127
(e) Sweetheart, exhb., ciii
Sylvia, exhb., v
(e) Tempest Vulcan, **A.M.** 1939...130
Chrysanthemum Tibshelf Delight, **A.M.** exhb., selected for trial, viii
(e) Tibshelf Shell, **A.M.*** Aug. 19, 1949...128
Tricia Lowe, exhb., v
(e) Una, 129
Valentine, **A.M.** 1949, exhb., selected for trial, v
Vampire, exhb., selected for trial, ix
Viscount, exhb., ix
Wedding Day, 78
(e) Wharfedale Yellow, 128
(e) White Bouquet, **F.C.C.*** Sept. 27, 1949...127
William Greenyer, **A.M.** Oct. 4, 1949, exhb., selected for trial, xi, 135
Winn Quinn, **A.M.** Nov. 1, 1949, exhb., xxxviii
Yellow Barbara, **A.M.** exhb., selected for trial, iv, v
Yellow Crossley, exhb., viii
Yellow Monsal Head, exhb., viii
Yellow Sands, **A.M.** Aug. 15, 1950, exhb., selected for trial, viii, ciii, 453
Yellow Star, ix
Yellow Symphony, exhb., iv
"Chrysanthemums for Amateur, and Market Grower," by F. W. Allerton, reviewed, 336
Chrysanthemums, Korean and Rubellum Varieties, at Wisley, 1949...78
"Cider-Making, The Principles and Practice of," by G. Warcollier, reviewed, 460
Cineraria, A leaf spot disease of (Senecio Cruentus) New to Great Britain, by D. E. Green, M.Sc., and M. Ann Hewlett, B.Sc., 199
Cirrhopetalum Fascinator, 422
"Citrus Industry, The, Vol. II. The Production of the Crop," edited by L. D. Batchelor and H. J. Webber, reviewed, 52
Cladosporium fulvum, 472
Clarke, Col. Stephenson, 187, 280, 285
"Clavaria and Allied Genera, A Monograph of," by E. J. H. Corner, reviewed, [457
Clematis alpina, 437
Armandii, 245, 437
Apple Blossom, 318
balearica, 56, 245
Barbara Jackman, exhb., lxxxvii
E. M. Pritchard, **A.M.** Aug. 29, 1950, exhb., cv
indivisa lobata, 437
macropetala, 320
montana rubra, 438
nannophylla, 377
orientalis, 18
recta, 259
Rehderiana, 339
tangutica, 18, 437
Clematoclethra lasioclada, 237
Clements, Julia, on "Fun with Flowers," reviewed, 368
Clerodendron Bungei, syn. C. foetidum, exhb., xxxvi, 376
Fargesii, 16
Thompsonae magnificum, 463
trichotomum, 16, 340, 376

Clethra alnifolia, 154, 300
var. Michauxii, 154
Clianthus magnificus, 440
Clintonia Andrewsii, 316
Clivia, aberrant growth in, v
kewensis Bodnant Yellow, **A.M.** April 4, 1950, exhb., lxxi, 266, **277**, 334
"Clove Tree, The," by G. E. Tidbury, reviewed, 80
Clutton-Brock, J., M. A., M.B., Growing Gentiana verna in very dry districts, 398
Cnicus Velenowskyi, 245
Codonopsis Bulleyana, 224
clematidea, 220, 224
convolvulacea, 224
var. Forrestii, 224
dicentrifolia, 223, 224
L. & S. 19620, **P.C.**, Aug. 29, 1950, cv
Meleagris, 224
mollis, 224
nervosa, 224
ovata, 220, 224
thalictrifolia, 309
vinciflora, 224
Coelogyne Dayana, **C.C.** exhb., xcix
fuliginosa, 422
Colchicum, susceptibility to Grey Bulb rot, 116
autumnale, 154
crocifolium, exhb., lxi
Szovitsii, exhb., lxi
Coleus thyrsoideus, 463
Colletia armata, 202, 356
cruciata, 19
horrida, 202
hystrix, 202
infausta, 202
spinosa, 202
Colquhounia vestita, exhb., iii
Columbine Turk's Cap, 328
Comber & Elliott, Messrs., 251
Comber, H., 163, 164, 165, 203, 205, 206, 248, 249, 251, 268, 280, 281, 283, 284
Comber J., 268
"Compassionate Herbs," by Mrs. C. F. Leyel, reviewed, 215
Compton, Professor, 325
Conanthera bifiora, 284
Simsii, 284
Conifers, various, xxxix
Convolvulus Cneorum, 320, 423
mauritanicus, 340
nitidus, 449, 452, 477, 478, 480
Cooke, R. B., 89
Cooper, Roland Edgar, 190
Cordyline indivisa, **237**, 240
Coridothymus (Thymus) capitatus, 482
Coris monspeliensis, 447
Corner, E. J. H., "A Monograph of Clavaria and Allied Genera," reviewed, 457
Cornus alba, 58
capitata (Bethamia fragifera), lv, 240, 246
controversa variegata, 318
florida, 173
var. rubra, 173
Kousa, **237**, 246, 316
chinensis, exhb., xcvi, 318
macrophylla, 316
Cornus mas, 56, 65
Nuttallii, 173
Westonbirt Variety, 58
Coronilla glauca var. pygmaea, 423
Corokia Cotoneaster, 240
Coronilla cappadocica, 245
glauca, 19
Correa alba, 339
Harrisii, 440
Coryanthes macrantha, 270, 271
Corydalis cashmeriana, 228, 307
meifolia, 313
solida, 150
Corylopsis Wilmottiae, 144, 150
yunnanensis, 152
Cotoneaster conspicua var. decora, 58, **66**
horizontalis, 424, 489
lactea, exhb., xcvi, 14, 423
microphylla, 307
pannosa, 489
Sabrina, **A.M.** Sept. 26, 1950...489
salicifolia, 423
serotina, 423
Cowen, D. V., "Flowering Trees and Shrubs in India," reviewed, 457
Crab Apple Horsted Crab, exhb., x
Craik, J., 156
Crane, M. B., F.R.S., A.L.S., V.M.H., The Origin and Improvement of Cultivated Plants, 427, 465
Crassula arborescens, 4
Crataegus × Carrierei, 59
durobrivensis, 59
Crawfurdia fasciculata, xxxix
Cremanthodium plantagineum, 311, **317**
Crewdson, Cicely M., on Meconopsis × Sheldoni, 198
Crinodendron dependens, 166
Hookeri, 328
Crinum Moorei, 339
Powelli, 440
Crocus aureus, 63
Balansae, 63
biflorus, 63
chrysanthus, 62
E. A. Bowles, 62
Moonlight, 62
Snow Bunting, 62
Yellow Hammer, 62
crinkled foliage of, exhb., lxix
Dutch Yellow, 63
Gladstone, 85
Imperati, 63
Kotschyanus (C. zonatus), xii
laevigatus, 62
var. Fontenayi, 62
longiflorus, exhb., lxix
nudiflorus, 376
Olivieri, 63
Salzmannii, xii
Sieberi, 62
speciosus, xii, 376
Striped Beauty, 85
susceptibility to Grey Bulb rot, 116
susianus, 5, 63
The Bishop, 85
Tomasinianus, 5, 63, **66**
Whitewell Purple, 63
zonatus, 376

"Crop Management and Soil Conservation," by J. F. Cox and L. E. Jackson, reviewed, 214
Crowther, D. S. on, "Fruit for Small Gardens," reviewed, 370
Cruckshanks, Alexander, 162, 167
Cruckshanksia cistiflora, 168
Cryptomeria japonica cristata, xxxix
var. dacrydioides, exhb., xciv
Cucumber, Ridge, Amsterdam Forcing, 41
Champion Ridge, 41
Cheltenham, 41
Danish Giant, 41
Evergreen, 41
Giant Delicacy, 41
Greenline, 41
Heuriedler, 42
Hybrid, 42
King of Ridge, **H.C.*** Sept. 12, 1949...41, 42
Langelands Giant Improved, 42
London Ridge, 42
Long Green, 42
Marketer, 42
Nuku, 42
Perfection, Ridge, **A.M.** Sept. 12, 1949...41
Prolific, 42
Spineless, 42
Success, 41
Telegraph Hybrid, 41
Torpedo, 42
Withers Ten-week Ridge, **H.C.*** Sept. 13, 1949...41
Cucumbers, Ridge, at Wisley, 1949...41
Cultivated Plants, The Origin and Improvement of, by M. B. Crane, F.R.S., A.L.S., V.M.H., 427, **441**, 465, **477**
Cuming, Mr., 162, 165, 203
Cunninghamia lanceolata, xxxix
Cuphea micropetala, 464
Cupressus at Powerscourt, Ireland, **237**
Duclouxii, 321
erecta viridis, 265
formosensis, 321
Lawsoniana, 437
× C. macrocarpa, 239
Headfortii, 321
Leylandii, 239
lusitanica, xxxix
flagellifera, xxxix
glauca pendula, 239
macrocarpa, **237**, 242, 244, 321, 437
nootkatensis nidiformis, 240
sempervirens, 265
Currant, Black, Laleham Beauty, exhb., i
Curtis Charles H., "Orchids their Description and Cultivation," reviewed, 490
Cuscata chilensis, 250
Cyananthus Delavayi, 224
Hayana, 302
Hookerii, 308
incanus, var. leiocalyx, 224
integer, 224
lobatus, 224, 260, 308
var. Farreri, 224
Cyananthus longiflorus, 224
microphyllus, 224, 260
palmatum sub-sp., rhodocephalum, 224
pedunculatus var. crenatus, 224, 302
reniforme, 224
Sheriffii, 224
Wardii, 224
Cyclamen × Atkinsii, 63, **66**
cilicium, 63
coum, 5, 63
cyprium, **A.M.** Oct. 4, 1949, exhb., xii, 135
europaeum, 154
graecum, 5, 154
ibericum, exhb., lx
libanoticum, 63
Mite (Tarsonemus pallidus), 72
neapolitanum, 60, 154, 301, 340, 377
persicum, exhb., lix, 5, 63, 185, **192**
repandum, 63
vernum, 63
var. hiemale, 63
Cyclamen persicum by F. Streeter, V.M.H., 185, **192**
Cydonia cardinalis, 440
(Chaenomeles) Maulei, 440
Maulei, 65
japonica, 65
Cymbidium, Albania var. Delight (albanense × Alexanderi), **A.M.** May 23, 1950, exhb., lxxxviii, 416
Clare Armstrong var. Greensleeves (Alexanderi × Mirella), **A.M.** May 23, 1950, exhb., lxxxviii, 416
var. Sunrise (Alexanderi × Mirella), **A.M.** May 2, 1950, exhb., lxxxi, 292
Claudona, (Claudette × Cremona), **F.C.C.** March 21, 1950, exhb., lxv, 292
Dorama (Dorchester × President Wilson), **P.C.**, April 4, 1950, exhb., lxxiii
Imogen Exbury var., exhb., lxiii
Kairouan Exbury var. (Rosanna × Adelma) **A.M.** Jan. 31, 1950, exhb., lviii, 292
Lady Moxham var. Amber (Sunrise × Ceres), **P.C.**, March 21, 1950, exhb., lxv
Louis Sander var. Ulysses (Alexanderi × Ceres), **A.M.** March 21, 1950, exhb., lxv, 292
Mayfair Castle Hill var. (Rosy Queen × Edzell), **A.M.** Feb. 14, 1950, exhb., lx, 292
Miretta var. Memoria A. A. McBean (Mirabel × Claudette), **F.C.C.** March 7, 1950, exhb., lxiii, 293
Pearlette, (Janette × Pearl), **A.M.** March 21, 1950, exhb., lxv, 293
Princess Elizabeth var. St. Andre (Alexanderi × Princess Astrid), **A.M.** March 7, 1950, exhb., lxiii, 293
Rozzika (Adraco × Rosanna), **A.M.** March 21, 1950, exhb., lxv, 293

Cymbidium, Verulam Exbury var. (Alexanderi × Tracyanum), **A.M.** Jan. 10, 1950, exhb., lvi, 293
Cymbidiums, a group shown at Vincent Sq., **277**
Cypripedium bellatulum, 422
Calceolus, 151
Crimea, **A.M.** Nov. 1, 1949, exhb., xxiii, xxxix, liv, 45
Delysia var. Radiance, **A.M.** Nov. 29, 1949, lvi 136
Desert Sun var. Mrs. Jenny Strauss, **A.M.** Jan. 10, 1950, exhb., lvi, 293
Fatland (Ballet Girl × Thebian), **A.M.** Feb. 14, 1950, exhb., lx, 293
Fairrieanum, 422
Godefroyae, 422
humile, 153
insigne Sanderae, 272
× Millmannii, **355**
pubescens, 153
Reginae (C. spectabile), 154, **155**, 316, 317
Socrates (Xantippe × Constance Flory), **A.M.** Jan. 10, 1950, exhb., lvi, 293
tibeticum, 224, **237**
Vanda M. Fearman (bellatulum × Delenatii), **A.M.** Aug. 1, 1950, exhb., cii
Vigilant (Whitehall × Beaufort), **A.M.** Feb. 14, 1950, exhb., lx, 293
Cyrilla racemiflora, 301
Cytisus × Burkwoodii, exhb., lxxxvii
Cyrthanthus Mackenii var. Cooperi, 423
kewensis, 174
nigricans, 76

Daboecia, autumn-flowering, 19
azorica, 153
cantabrica, 153, 301, 340
Dacrydium Franklinii, exhb., c
Daffodil, Scented, lxix
Dahlia Abbot, **H.C.*** Sept. 8, 1949...133
Airline, **H.C.*** Aug. 8, 1949...131
Aldyth Joy, **H.C.*** Sept. 8, 1949...134
Almeh, exhb., selected for trial, ciii
Amalgam, selected for trial, xii
Ambassadeur von Kleffens, **H.C.*** Aug. 18, 1949...131
Amiable, exhb., selected for trial, iv
Ami George, 134
Anna Benedict, 131
Antler, 134
Appledore, exhb., selected for trial, ciii
Aristos, exhb., selected for trial, iv
Atom, **H.C.** 1947...132
Axford Triumph, exhb., viii
Baby Willy, 133
Bantam, 132
Barbara Bacon, exhb., selected for trial, ciii
Barrowford, 132
Barry Cotter, 132
Beckley, exhb., selected for trial, ciii
Bedford Rose, exhb., selected for trial, iii
Bentley, exhb., selected for trial, iii
Bessie, **A.M.** 1943...134
Dahlia Bess Smith, **H.C.*** Sept. 8, 1949...131
Bettabracht, **H.C.** 1947...133
Blueboat, exhb., selected for trial, iii
Bluelight, **H.C.*** Aug. 18, 1949...133
Blushes, exhb., selected for trial, viii
Bonus, 133
Bordon, exhb., selected for trial, xii
Boundstone, 132
Bourne Crimson, **A.M.** 1947...132
Bowland, exhb., iii
Brabazon, exhb., selected for trial, iv
Brother Justinus, **A.M.*** Sept. 8, 1949, 133
Brighton, 132
Brooklands, 134
Bruidegom's Mystery, 134
Canon Griffiths, exhb., selected for trial, ciii
Caress, **H.C.*** Sept. 8th, 1949...132
Carmenita, **H.C.*** Aug. 18, 1949...131
Cease Fire **H.C.*** Aug. 18, 1949...131
Charles Andrews, **A.M.*** Sept. 8, 1949, 133
Charming, 134
China Rose, 134
Constellation, 134
Crimson Pennant, 132
Croydon Masterpiece, **A.M.** Aug. 1, 1950, exhb., selected for trial, ciii
Crusoe, **A.M.** 1933...132
Cymru, exhb., selected for trial, iv
Dainty Rose, 134
David Hartley, exhb., selected for trial, viii
Deepdene, **H.C.*** Sept. 8, 1949...132
Deuil du Roi Albert, **A.M.*** Sept. 8, 1949...131
Dockenfield, exhb., selected for trial, viii
Don's Surprise, exhb., selected for trial, iv
Doris Pembroke, **H.C.*** Sept. 8, 1949, 134
Dorothy Jordan Lloyd, exhb., selected for trial, iv
Stanton, 132
Douglas Meredith, exhb., selected for trial, iii
Eastwood Glory, exhb., selected for trial, viii
Eileen Quinnell, 131
Ella Britton, **H.C.*** Aug. 18, 1949...134
Elizabeth Sawyer, 134
Esme Swall, exhb., selected for trial, iii
Ester Burt, exhb., selected for trial, xii
Fairy, 134
Farnham Gem, 132
Favourita, 134
F. Oliver, exhb., selected for trial, iv
F. E. Hoffer, 131
Finesse, 134
Firefly, 134
Firgrove, exhb., selected for trial, xii
Florist, 132
Fortune, **A.M.** 1938...132
Frank Dawn, exhb., selected for trial, iv
Frank K. Dowden, 131
Frank Serpa, 131

Dahlia, Frankendael, exhb., selected for trial, iv
Fune, 132
Fynlila, exhb., selected for trial, iv
Gerrie Hoek, **A.M.*** Sept. 8, 1949...131
Glacier, 134
Glen Mount, 134
Gloria van Heemstede, **H.C.*** Aug. 18, 1949...132
Gold Digger, 134
Golden Rechtschaffenheit, exhb., selected for trial, iv
Good Morning, **H.C.*** Aug. 18, 1949, 134
Gothic, exhb., selected for trial, iv
Greta Woodhouse, **A.M.*** Sept. 8, 1949...133
Harold Weller, 131
Heathfield, exhb., selected for trial, xii
Heathrow, exhb., selected for trial, iv
Hoek's Glorie, 133
Hopette, **H.C.*** Sept. 8, 1949...133
Hopeful, **A.M.*** Aug. 18, 1949...133
Hylla, 134
Ibex, 132
Ice Cream, **H.C.*** Sept. 8, 1949...132
Icterus, exhb., selected for trial, xii
Iden, exhb., selected for trial, xii
Jacqueline, 134
Jaune Belge, exhb., selected for trial, ciii
Jean Barnes, **A.M.*** Sept. 8, 1949...132
Jeff Cooper, exhb., selected for trial, [viii
Jescot Carmen, 134
Coed, 134
Herbert, 134
Hilda, exhb., selected for trial, iv
Jess, 132
Jim, **H.C.*** Sept. 8, 1949...132
Kitty, 134
Lingold, exhb., selected for trial, ciii
Merilee, 134
No. 620, exhb., selected for trial, ciii
Orange, exhb., selected for trial, iii
Yellow, 134
Jeslea, 132
Jessie Lane, exhb., selected for trial, xii
Jo Wakeford, exhb., selected for trial, xii
John Busbridge, **A.M.*** Sept. 8, 1949, 130
Shores, exhb., selected for trial, viii
Joy Stubbs, 134
Justnus Kerner, **A.M.*** Sept. 8, 1949, 131
Kannon van Kerkhoven, 134
Kathie Haas, exhb., selected for trial, viii
Kendal Pride, exhb., selected for trial, iv
Lady Kindersley, 130
Lavender Perfection, 131
Lillibet, 134
Lindy, exhb., selected for trial, viii
Little Eric, exhb., selected for trial, iv
Francis, exhb., selected for trial, iv
Loesje, exhb., selected for trial, ciii
Lorna Evans, 131
Lovebird, 132
Luck, 133
Mansfield, 134
Marden Ash, 131
Margaret Colvin, 131
Rose, 134
Maria Orbaan, 132
Mary Parratt, 132
Wills, exhb., selected for trial, ciii
Medway, exhb., selected for trial, xii
Melba Hankin, exhb., selected for trial, iv
Moeder Ballego, **H.C.** 1948...133
Moor Park, 132
Morning Glow, **A.M.*** Sept. 8, 1949, 130
Joy, **H.C.** 1948...132
Mother of Pearl, 133
Mothersmind, exhb., selected for trial, iv
Mrs. O. M. Courage, 130
My Joy, 133
Nanook, 131
Nearest Blue, 131
Newnham White, **H.C.** 1948...132
Noirmoutier, 134
Nora Pickett, 134
Northiam, exhb., selected for trial, xii
Noviet, 134
Ormerod, exhb., selected for trial, iv
Ortolan, 131
Parma, 132
Parvane, exhb., selected for trial, iv
Patricia Leachman, 133
Pauline New, **H.C.***Sept. 8, 1949...133
Peggy Mathams, exhb., selected for trial, viii
Pelegrina, 134
Percy, **H.C.** 1947...133
Philip Aslett, 132
Phoebe Mays, **H.C.*** Sept. 8, 1949, 131
Pierre Thiebaut, **H.C.*** Sept. 8, 1949, 132
Pink Nymph, exhb., selected for trial, xii
Prune, 132
Puffin, 132
Punctuality, 134
R. J. Cook, 134
Redpoll, 133
Restful, 134
Roland, **H.C.*** Aug. 8, 1949...132
Rosanna, **A.M.*** Aug. 18, 1949...131
Rose, 132
Rose Hill, **H.C.** 1948...134
Rosedew, exhb., viii
Rosemary Golby, exhb., selected for trial, iii
Rowledge, exhb., selected for trial, iii
Sachet, **A.M.*** Sept. 8, 1949...132
Samuel, 134
Scarletta, exhb., selected for trial, iv
Sea Swallow, 133
Seedlings, exhb., iii
Sheila Brunton, exhb., selected for trial, iii
Leslie, exhb., selected for trial, xii
Mappin, 132
Shirley Westwell, **A.M.*** Aug. 18, 1949...132

Dahlia Shirley Yellow, 134
Speck, 134
Sportsman, 134
Standfast, 131
Steyning, exhb., selected for trial, ciii
Sweetness, 134
Teal, 132
Thistle, exhb., selected for trial, iii
Tintern, exhb., selected for trial, viii
Tom Barnes, **H.C.*** Sept. 8, 1949...132
Topmix, 134
Trajectum, **H.C.*** Sept. 8, 1949...134
Trim, 132
Tryst, 134
Twilight, 131
Ulva Quarrall, exhb., selected for tiral, viii
Vargas Gardner, exhb., selected for trial, iv
variabilis, 434, 469
Vera Higgins, **H.W.*** Aug. 18, 1949, 130
Violet Hope, exhb., viii
viridiflora, exhb., civ
Vivianne Coppens, **A.M.*** Aug. 18, 1949...133
Volkaert's Champion, 133
W. Griffiths, exhb., selected for trial, iv
Wendy Jill, exhb., selected for trial, viii
White Guard, **H.C.*** Aug. 18, 1949, 131
White Superior, **H.C.*** Sept. 8, 1949, 134
William Evans, exhb., selected for trial, iii
Winifred Stredwick, 131
Winnie Way, exhb., iii
Yellow Plume, exhb , selected for trial, ciii
Zinnita, 132
Dahlia Trials at Wisley, 1949...**111**, 130
"Dahlien im Garten und im Haus," by L. Jelitto and P. Pfitzer, reviewed, 457
Dandy, J. E., M.A., F.L.S., on The Highdown Magnolia, 159
Daphne gnidium, 482
Mezereum, 56, 65
pontica, 152
retusa, 77
Somerset, Bodnant form, exhb., lxxxvii
tangutica, 76
Darwin, Charles, 163
"Das Chrysanthemum, sein Formenreichtum and seine Kultur," by M. Marggraf and G. Hartmann, reviewed, 457
David, Père, 208
Davidia involucrata, 238, 321, 443
Davis, Peter, 110, 481
Davy, Thomas, 163
Deakin, Mr and Mrs. A. C., 330
Deciduous Conifers, Cuttings of, by Miles Hadfield, 487
Deinanthe coerulea, 225
de Lestang, Albert, 73
Delphinium Ajacis, exhb., xciv
Belladonna Fairy Wings, exhb., xcvii
Delphinium Bridesmaid, **F.C.C.*** July 4, 1949...31
Brunonianum, 228, 312, 317
Cantata, **H.C.*** July 4, 1949...31
Charles F. Langdon, **F.C.C.*** July 4, 1949...31
Delius, **H.C.*** July 4, 1949...31
denudata, sp. near, 308, 317
Elizabeth Schumann, exhb., selected for trial, xcvii
Frederick Grisewood, **H.C.*** July 4, 1949, exhb., xcvii, 32
likiangense, 225
orientale, exhb., xciv
Pylzowii, 225
Royalist, exhb., selected for trial, xcvii
Ruth Langdon, **A.M.*** July 4, 1949...31
Ruysii, 435
Seedlings, exhb., xciii
Startling, exhb., xcvii
tatsienense, 225
White Seedling, No. 5, exhb., selected for trial, xcv
"Delphiniums," by Frank Bishop, reviewed, 138
"Delphiniums, Their history and cultivation," by G. A. R. Phillips, reviewed, 138
Delphiniums at Wisley, 1949...31
De Naole, Pietro, 476
Dendrobium delicatum album, exhb., lxvi
nobile, 271
Winifred Fortescue, **A.M.** March 21, 1950, lxv, 293
Dendromecon rigidum, 242
Dendroseris littoralis, 248
de Rothschild, Lionel, 357
Desfontainia spinosa, 250, 355
Desmodium filiaefolium, 304
Deutzia globosa, 315
Kalmiaeflora, 315
longifolia Veitchii, 240
mollis, 246
purpurascens, 315
Wilsonae, 318
Dhwoj & Sharma, Messrs., 302
Dianella tasmanica, 443
Dianthus Allwoodii, exhb., xci, xcv, ci
Faith, exhb., selected for trial, xciii
Hope, exhb., selected for trial, xciii
Matilda, exhb., selected for trial, lxxxix
Show Excellence, exhb., selected for trial, lxxxix
Caryophyllus, 341, 342
Christchurch Salmon, exhb., xciii
Cottage Loveliness, exhb., selected for trial, xciii
Daydown, exhb., xcvii
Duffy, exhb., xciii
Jack Cranfield-Parker, exhb., xciii
James S. Wells, exhb., xciii
Joey, exhb., xciii
June Morning, exhb., xciii
Margaret Curtis, exhb., xcvii
Mary Lowe Hall Wells, exhb., xciii
Mitzi, exhb., xciii
Mrs. A. E. Wells, exhb., xciii

Dianthus, Mrs. Cranfield-Parker, exhb., xciii
Mrs. Ellen Cane, exhb., xciii
Nicky, exhb., xciii
Phoenix, exhb., xciii
Pink Frill, exhb., xciii
Pretty Polly, exhb., xciii
Red Eye, exhb., xciii
Red Petrel, exhb., xciii
Seedling exhb., selected for trial, cii
Seedlings, A/3/50, A/4/50, A/1/50, A/2/50, exhb., xciii
Show Discovery, **A.M.** June 13, 1950, exhb., selected for trial, xciii, 417
Pearl, **A.M.** June 13, 1950, exhb., selected for trial, xciii, 417
Sidney P. Wells, exhb., xciii
William Brownhill, **A.M.** June 13, 1950, exhb., selected for trial, xciii, xcv, 417
"Dianthus, The: A Flower Monograph," by Will Ingwersen, reviewed, 45
Diapensia Wardii, 88, **110**
Dicentra (Dielytra) spectabilis, 116
exima, 151
formosa alba, **A.M.** May 23, 1950, exhb., lxxxvii, 417
Dicksonia antarctica, **440**
Dictamnus albus, 77
var. caucasicus, 77
var. purpureus, 448
var. ruber, 77
Fraxinella, 77, 448
hispanicus, 448
Didissandra sp., 225
"Die Baumschule" (The Tree and Shrub Nursery), by Gerd Krüssmann, reviewed, 47
"Die Frieland-Schmuckstauden, 1: Anzucht und Kultur," by E. Eiselt and G. Krüssmann, reviewed, 457
Dierama pulcherrima, 440
Digitalis ambigua, 259
laciniata, 482
mariana, 485
mertonensis, 435
orientalis, exhb., xcix
Dimorphotheca chrysanthemifolia, exhb., lxxxvii
Dionysia bryoides, **P.C.** 1944, exhb.; **A.M.** Feb. 14, 1950, lx, 414
Diostea juncea, 282
Diplacus glutinosus, 339
Diplarche multiflora, 89, **110**
Diphylleia cynosa, 153
Disanthus cerdicifolius, 377
Discaria discolor, 203
serratifolia, 203
Disporum Smithii, 153
Dix, J. F. Ch., Hippeastrum × gracilis, 360
Don, D., 302
Donnersmark, Count Leo Victor Felix Henkel Von, 403
Donovan, Mr., 316
Douglas, Mr., 210
Downton, G., 162
Draba hispanica, 447
Dracocephalum bullatum, 225
Dracocephalum caulophyllum, 225
Forrestii, 225
heterophyllum, 225
Isabellae, 225
speciosum, 225
tanguticum, 225
"Dragonflies of the British Isles, The," by Cynthia Longfield, reviewed, 51
Drimys sp., 162
aromatica, 239, 442
colorata, 238
Winteri, 239, 356, 442
Dryas octopetala, 320
Dummer, R. H., 24

Earheart, Harry, 109
"Earthworm, Harnessing the," by T. J. Barrett, reviewed, 50
Eccremocarpus sp., 280
scaber, 437
Echium albicans, 479
fastuosum, 440
Edinburgh Botanic Garden, 7
Edraianthus graminifolius, exhb., xc
Eiselt, E. and G. Krüssmann, "Die Freiland-Schmuchkstauden, 1: Anund Kultur," reviewed, 457
Elaeagnus glabra, exhb., lv
macrophylla, exhb., xxxviii
pungens var. maculata, 55
Elaeocarpus cyaneus, 219
Elder, White fruited, exhb., ix
Ellacombe, Canon, 330
Elliott, Clarence, 164, 167, 207, 249, 251, 401
Elliott & Gourlay, Messrs., 206, 281, 282, 283, 284, 286
Elm, Dwarf, exhb., ix
Elwes, H. J., 166, 282, 283
Embothrium coccineum, 162, 358, 401, 443
lanceolatum, 358
longifolium, 357, 358
Emmerton, Isaac, 389
Enkianthus perulatus, 144, 377
Epacris ardentissima, 423
impressa, 423, 463
Ephedra andina, 287
Epimedium concinnum, 150
macranthum, 151
pinnatum, 150
pulchellum, 151
versicolor, 150
Youngianum niveum, exhb., lxxix
Eranthis Tubergenii (hyemalis × cilicica), 55
Ercilla volubilis, 282
Erica arborea, 241, 464
arborea alpina, 61
australis, 241
canaliculata, 423, 463
carnea, 5, 61, 85, 149, 155
King George, 5, 61
Queen Mary, 5, 61
ciliaris, 19, 259, 301
var. Maweana, 301

Erica cinerea, 19, 154, 259, 301
Cevennes, 340
codonodes, 464
× darleyensis, 5, 56
mediterranea, 5, 56, 438, 441
Mrs. D. F. Maxwell, 19
Pink Beauty, 85
Springwood White, 61
terminalis, 259
Tetralix, 19, 301
Thomas Kingscote, 85
vagans, 19, 259
grandiflora, 340, 376
Pyrenees Pink, 340
Veitchii, 464
Watsoni, 301
Winter Beauty, 85
Erigeron glaucus roseus MacPenny, exhb., xc
mucronatus, 240
Erinacea Anthyllis, 174, 449, 452, 479
Erinus alpinus, 331
var. parviflorus, 449
Eriobotrya japonica, exhb., lxxii, **477**
Eriobotrya japonica by Oliver E. P. Wyatt, 488
Eriophyton Wallichianum, 311
Eriosma lanigerum, 473
Eriosyce sandillon, 207
Eritrichium nanum, exhb., lxxix
Erodium alpinum, 316
cheilanthifolium, 447, 449, 452
Eryngium campestre, 445
paniculatum, 207
Erythrina americana, 401
Crista-galli, 398
insignis, 398
Erythronium Dens-canis, 150
revolutum, 144
tuolumnense, 86, 144
Escallonia Apple Blossom, 220
C. F. Ball, 13
exoniensis, 17
Fonkii, 204
illinata, 205
Iveyana, 17, 220
Langleyensis, 204, 220, 443
macrantha, 204, 357
montevidensis, 17, 220
Phillipiana, 204
pterocladon, 205, 245
pulverulenta, 205
punctata, 204
revoluta, 205
rubra, 204
viscosa, 205
Eucalyptus alpina, 188
amygdalina, 189
biangularis, 187
caesia, 189
Cambagei, 189
cinerea, 189
coccifera, exhb., xcvi, 187, 188, 246, 440, 442
cordata, 187, 189, 239, 442
coriacea, 442
corrigera, 442
Dalrympleana, exhb., xcvi, 189
Delegatensis, 187
Eucalyptus divaricata, 188
ficifolia, 187, 189
Forrestiana, 189
gigantea, 187, 188, 189, 246
globulus, 186, 187, 189, 241, 442
glutinosa (pinnatifolia), 438, **441**
Groesa, 189
Gunnii, **A.M.** June 27, 1950, exhb., xcvi, 186, 187, 188, 189, **193**, 246, 410, 442
whittinghamensis, exhb., vii, 186, 188, 442
Johnstoni, 187, 188, 193
Lehmanni, 189
leucoxylon, 189
linearis, 189
Macarthuri, 187, 189
Moorei, 246
Muelleri, 187, 188
niphophila, 188, 189
obliqua, 186, 187, 189
ovata, 187, 189
parvifolia, 188
pauciflora, 189
Perriniana, 189
polyanthemos, 187
Preissiana, 189
pulverulenta, 187, 189
regnans, 187, 189
resinifera, 189
Risdoni, 189
rostrata, 189
rubida, 189
saligna, 189
sepulchralis, 189
sideroxylon, 189
Sieberiana, 189
Stuartiana, 187
subcrenulata, 187, 188
tasmanica, 189
torquata, 189
urnigera, 187, 188, 239, 246
vernicosa, 187, 188
viminalis, 187, 189, 246
virgata, 187
Eucalyptus in the British Isles, by D. Martin, 186
Eucryphia sp., 162
cordifolia, 265, 356, 438
glutinosa (pinnatifolia), 14, 160, 266
nymansensis (glutinosa × cordifolia) 14, 260, 301
Eugenia apiculata, 205, 355
Luma, 205
Euonymus alatus, 377, 423
europaeus Red Cascade, **A.M.** Nov. 1, 1949, exhb., xxxviii, 43
fimbriatus, 362
pendulus, by J. W. Hunkin (Bishop of Truro), 362
semiexsertus, 59
Eupatorium micranthum, 464
purpureum, 329
Weinmannianum, 242
Evans, A., 361
Evans, A., on The Peat Garden, 145
Evelyn, John, 192
Evodia hupehensis, exhb.; **A.M.** Sept. 6, 1949, iii, 43

Ewing, Dr. H. E., 69, 70, 71
Exacum affine, 67, 72
Examinations, 1
Exhibits from Fellows, Small, 2

Fabiana imbricata, 251, 356, 440
Fagus Engleriana, 246
Falmouth, Viscount, 327
Farrer, Reginald, 77, 110, 227, 235
Farringdon, E. I., Editor for the Massachusetts Horticultural Society, "The Gardener's Travel Book," reviewed, 372
Fasciation, v
Fascicularia bicolor, exhb.; **A.M.** Sept. 6, 1949, iii, 44, 339, 464
Faucaria tigrina, 464
Faulkner, R. P., on The "Science of Turf Cultivation," reviewed, 296
Fellows, Notes from, 108, 156, 359, 397, 487
Fiedler, C. R., 69
"Ferns, The Observers' Book of British," by W. J. Stokoe, reviewed, 492
"Fig, The," by Ira J. Condit, reviewed, 46
Fitzroya patagonica, 162
Flora Antarctica, 165, 205
  Australiensis, 75
"Floristry your Business, Making," by Angela Johnson, reviewed, 51
Floto, Ernst Wilhelm, 404
"Flower Paintings: Adrian Feint," Ed. by S. Ure Smith, reviewed, 212
"Flower Pieces, Collected," by Helen Blaxland, reviewed, 52
"Flowering Trees and Shrubs in India,'' by D. V. Cowen, reviewed, 457
"Flowers for Cutting," by G. A. R. Phillips, reviewed, 51
"Flowers, Fun with," by Julia Clements, reviewed, 368
"Flowers, In Praise of," by Sir William Beach Thomas, reviewed, 51
"Flowers and Vegetables without Soil," by A. J. Simpson, reviewed, 168
"Flowers that bloom in the Summer," by A. W. Hatfield, reviewed, 372
"Flowers to know and Grow," by Audrey Wynne Hatfield, reviewed, 491
Forrest, George, 14, 68, 86, 226, 227, 229
Forsythia, Fasciated, exhb., c
  Gall like growths, lxix
  Giraldiana, 85
  intermedia var. spectabilis, exhb., c, 85
  ovata, 85
  suspensa, 85
Fortune, Robert, 59
Fothergill, Mr., 194
Fothergilla major, 152, 155
  monticola, 155, 377
Fragaria chiloensis, 204, 432, 434
  elatior, 432, 434
  vesca, 432, 434
  virginiana, 432, 434
Francoa appendiculata, 205
  ramosa, 205
  sonchifolia, 205
Frankenia Reuteri, 445
Fraxinus excelsior pendula, 237
  Paxiana, 321
Freesia Blushing Bride, **A.M.** 1948, exhb., lix
  Goldcup, **A.M.** Feb. 14, 1950, exhb., lix, 254
  Orange Nassau, **A.M.*** 1948, exhb., lxiv
  Snowdrift, exhb., lix
  Souvenir, **A.M.** 1948, exhb., lix
Fremontia californica, 13, 244, 328
  mexicana, 258
Frezier, M., 204
Fritillaria acmopetala, exhb., c
  bucharica, exhb., lxix
  Capsules, exhb., c
  cirrhosa, 308
  gracilis, exhb., c
  imperialis, 116
  karadaghensis, exhb., c
  lanceolata, exhb., c
  Meleagris, 151, 191
  Olivieri, exhb., c
  pallidiflora, exhb., c
  pudica, exhb., c
  pyrenaica, exhb., c
  Sewerzowii, exhb., lxix
"Fruit Culture," by A. H. Hoare," reviewed, 139
"Fruit for Small Gardens," by D. S. Crowther, reviewed, 370
"Fruit Grower's Diary, A," by Raymond Bush, reviewed, 456
"Fruit-Growing for Amateurs," Edited by N. P. Harvey, reviewed, 140
"Fruit Juice Production, Recent Advances," reviewed, 492
"Fruit Tree Raising, Rootstocks and Propagation," reviewed, 214
Fruit and Vegetable Committee, 1
Fryberg, Sir Bernard, 264
Fuchsia alba, 207
  Colensoi, 73
  var. conica, 206
  corymbifolia, 73
  decorticata, 328
  excorticata, 240
  fulgens, 73
  lycioides syn. F. rosea, 207
  macrostemma syn. El Chilco, 206
  magellanica, 73, 206, 316, 340, 357
    discolor, 377
      var. Riccartonii, 17
  procumbens, 464
  Rose of Castile Improved, exhb., vii
  T. Bonstedt, 73
  Thalia, 73
  triphylla Thalia, exhb., vii
  unnamed seedling No. 1 (F. magellanica × L'Enfant Prodigue), selected for trial, xxxvi
"Fuchsia Survey, A," by W. P. Wood, reviewed, 371
Fuchsias, exhb., ii
Fumana procumbens, 452

"Fungi and Plant Disease," by R. B. Mundkur, reviewed, 371
Funkia argentea variegata, 441
undulata, 441

Gedd, C. H., 71
Gaillardia Eastwood, exhb., selected for trial, ii
Draycott Beauty, exhb., selected for trial, ii
Fasciated, exhb., xcvii
Galanthus, Atkinsii, 64
byzantinus, exhb., 55, 64, lxi
corcyrensis, 64
caucasicus, exhb., lxi
Elwesii, 55, 64
graecus, exhb., lxi
nivalis, exhb., lxi, 63
sub-sp. Olgae, **A.M.** Oct. 18, 1949, exhb., xxxvi, 44, 63
plicatus, 64
Rachelae, 63
species, exhb., lxi
Straffan Variety, 64, **66**
Warham, 64
Galax aphylla, 330
"Gall Midges of Economic Importance," by H. F. Barnes, reviewed, 50, 212
"Gall Midges of Miscellaneous Crops," reviewed, 212
Garden in Winter, The, by Patrick M. Synge, 57
Garden Pinks at Wisley, 1949...30
"Garden, Utility, for Home Needs," by A. G. L. Hellyer, reviewed, 296
"Garden Weeds and their Control," by S. B. Whitehead, D.Sc., reviewed, 46
"Gardener, Hints for the Town," reviewed, 168
"Gardener's Log, A," by Edna Walling, reviewed, 216
"Gardener's Travel Book, The," Edited for the Massachusetts Horticultural Society by E. I. Farrington, reviewed, 372
"Gardens and Gardening," edited by F.A.Mercer and Roy Hay, reviewed, 296
"Gardens, On the Making of," by Sir George Sitwell, reviewed, 137
"Garden's Scrapbook of Wit and Wisdom, My," by Theo. A. Stevens, reviewed, 49
Garnet, C. S., 23
Garrya elliptica, 5, 59
Gaulnettya wisleyensis, 155
Gaultheria antipoda, 155
cuneata, 154
depressa, 155
hispida, 152, 153, 155
Miqueliana, 154
nummularioides var. minuta, 155
ovatifolia, 155
procumbens, 155
pyrolifolia, 155
semi-infera, **A.M.** Sept. 26, 1950...489
Shallon, 153, 155
sinensis, 155
tetramera, **A.M.** Sept. 12, 1950...489
Gaultheria trichophylla, 309
Veitchiana, 152, 155
Genera Plantarum, 163
"Genetics, Dictionary of," by Dr. R. L. Knight, revised, 295
"Genetics, The Elements of," by C. D. Darlington and K. Mather, reviewed, 136
Genista aethnensis, 13, 27, 301, 329
cinerea, 13, 220, 259, 318
dalmatica, 220
Lydia, 220
virgata, 13
Gentiana acaulis, exhb., lxxx, 266
asclepiadea, 300, 340, 443
cachemirica, 111, 226
Farreri, 110, 111, 226, 443
fascicularis, xxxix
gilvostriata, 226
gracilipes, 300
× hascombensis, 300
hexaphylla, 226
Kurroo, 226
lagodechiana, 111
Loderi, 111
Macaulayi, 111
nubigena, 311
ornata, 226, 302
septemfida, 111, 300
sino-ornata, 111, 225, 226, 240, 266, 339, 443
Veitchiorum, 111, 226, 237
verna, 398
Waltonii, 226, **236**
Gentiana verna in very dry districts, Growing, by J. Clutton-Brock, M.A., M.B., 398
Geranium armenum, 244, 320
Attar of Roses, 197
collinum, 226
Farreri, 226, 440
Godfrey's Pride, 197
ibericum, 242, 244, 316, 318
napuligerum, 226
odoratissimum, 196
pratense fl. pl., 244
Gerberas Pillhead Inniskilling, exhb., ii
Sarah, exhb., ii
Sunglow, exhb., ii
Supreme, exhb., ii
Pylzowianum, 226
subcaulescens, 226
Germination in rolls of filter paper, v
Gesnera chromatella, 422
Geum chiloense, 204
coccineum, 204
magellanicum, 204
Quellyon, 204
Giffney, Mr., 246
Gilia californica, 300
Gillies, Dr., 162
Gilliesia graminea, 286
Ginkgo biloba, 477
"Gladioli," by A. J. Macself, reviewed, 138
Gladioli at Wisley, 1949...32
Gladiolus Alice Tiplady, **H.C.** 1926...33
Aljechen, **A.M.**° July 25, 1949...35
Ambra, **H.C.**° Aug. 4, 1949...32

Gladiolus America, 112
Amor, A.M. 1931...33
Apricot Queen, **A.M.** 1934...32
Aranjuez **H.C.*** Aug. 4, 1949...32
Atlantic, **A.M.*** July 25, 1949...34
Badische Flagge, **A.M.** 1931...32
Bell Jaune, **H.C.*** July 25, 1949...32
Biarritz, **H.C.*** Aug. 4, 1949...34
Biedermeier, **H.C.*** July 25, 1949...33
Bonfire, **H.C.** 1937...34
ceresianus, exhb., lxxix
Cherry Glow, 33
Chrysantha, 32
Circe, **F.C.C.*** July 25, 1949...33
Crimson Glow, 35
Fairy Dress (Elfenkleid), **A.M.*** July 25, 1949...32
Goya, **H.C.*** July 25, 1949...33
Guy Mannering, 35
Helen Eaken, **A.M.*** July 25, 1949...32
Henri Dunant, **A.M.*** July 18, 1949, 34
Hondecouter, **A.M.*** July 25, 1949...34
Je maintiendrai, **A.M.*** July 25, 1949, 34
Jeanette, **H.C.*** July 18, 1949...33
Jo Wagenaar, **F.C.C.*** July 25, 1949, 34
Johan van Konynenburg, **A.M.*** Aug. 4, 1949...33
John Pettitt, 34
Libretto, **A.M.*** July 18, 1949...35
Lutetia, **A.M.*** Aug. 4, 1949...34
Maiden's Blush, **H.C.** 1926...32
Mantegna, **H.C.*** Aug. 4, 1949...33
Marie Antoinette, **A.M.*** Aug. 4, 1949, 33
New Europe, **A.M.*** Aug. 4, 1949...34
Normandy, 33
Orange Butterfly, 32
Pactolus, **A.M.*** July 25, 1949...32
Paul Rubens, **H.C.*** Aug. 4, 1949...35
Paul Véronèse, **A.M.*** July 25, 1949, 33
Picardy, 112
Potgieter, 34
Prince of Wales, 112
Ravel, **F.C.C.*** July 25, 1949...35
species, exhb., c
Sweetheart, 33
Thrips, civ, 375
Titian, **A.M.*** Aug. 4, 1949...34
Urses, **A.M.*** July 25, 1949...33
Va Banque, **H.C.*** Aug. 4, 1949...34
Vermeer, **A.M.*** July 25, 1949...33
Vincent van Gogh, **A.M.*** July 18, 1949...34
White Herald, **H.C.*** July 18, 1949...32
Gladiolus, Aerial corm of, xxxvii
corms, exhb., lxxv
"Glasshouse Flowers for Profit, Modern," by W. E. Shewell-Cooper, reviewed, 492
"Glasshouse, Better crops," by W. J. C. Lawrence, reviewed, 48
"Glasshouses, The John Innes," reviewed, 459
Glaucidium palmatum, 153
Glenday, Sir Vincent, K.C.M.G., O.B.E., 486
Globularia bellidifolia, 174
spinosa, 447, 452
Gloriosa Carsoni, 23
Plantii (G. virescens var. Plantii), 23
Rothschildiana, 22, 27, 260
superba, 23
Verschuurii, Th. Hoog, sp. nova, 22, 27
Gloriosa, A new (G. Verschuurii), by Thomas Hoog, 22
"Gloucestershire, Flora of," reviewed, 140
Glyptostrobus heterophyllus, 240
Gola, Signor Giuseppe, 478
Gordonia pubescens, 442
Gould, N. K., 'on Amaryllis Belladonna and Nerine Bowdeni, 21
Gould, Sir Basil, 190
Gourlay, W. Balfour on, Puya Alpestris in its Native Land, 399
Gourlay & Elliott, Messrs., 164, 248
Graaff, Jan de, 259
Graham, George, 239
"Grape Vine in England, The," by Edward Hyams, reviewed, 295
"Grapes, Outdoor, in Cold Climates," by R. Barrington Brock, reviewed, 213
Gray, Mr., 290
Green, D. E., M.Sc., and M. Ann Hewlett, B.Sc., on A leaf spot disease of Cineraria (Senecio Cruentus) new to Great Britain, 199
Greigia sphacelata, 283
Grevillea robusta, 398
Grey, C. H., on Iris susiana, 362
Grey Bulb Rot of Tulip, by W. C. Moore, 113
Griffith, Mr. William, 190
"Griqualand West (South Africa), Preliminary Check List of the Flowering Plants and Ferns of," by M. Wilman, reviewed, 215
Griselinia littoralis, 443
Guevina avellana, 356, 442
Guilandino Melchirre, 477
Gunnera chilensis, 205
(syn. scarba), 205
magellanica, 205
manicata, 205, 441

Haberlea Ferdinandi-Coburgi, 151
Kewensis, 151
rhodopensis, 151
alba, 151
latifolia, 151
virginalis, 151
Habernaria conopsea, 154
Habranthus pratensis, 285, 440
robustus, exhb., xciv
Hadfield Miles, Cuttings of Deciduous Conifers, 487
Hales, Dr. Stephen, 77
Halesia carolina, exhb., lxxxi, 77, 173
monticola, 77
tetraptera, 77
Hall, Sir Daniel, 210
Hamamelis mollis, 5, 59
var. brevipetala, exhb., lviii
japonica, 56
var. flavo-purpurascens, exhb., lviii

Hamamelis japonica, Zuccariniana, 60
Hamilton, Mr., 302
Hampton, Dr. F. A., 192, 193, 196
"Hampton Court, The Gardens of," by Mollie Sands, reviewed, 460
Hanbury, Dorothy. Some Notes from the Hanbury Gardens, La Mortola, Ventimiglia, Italy, 398
Hanbury, Sir Thomas, 3
Hanbury Gardens, La Mortola, Ventimiglia, Italy. Some Notes from the, by Dorothy Hanbury, 398
Hanger, F., on Buddleia alternifolia, 235
Hanger, Francis, 67
Haplopappus coronopifolius, 249
pectinatus, 249
Harland, Dr. S. C., 486
Hartmann, G. and M. Marggraf, "Das Chrysanthemum, sein Formenreichtum and seine Kultur," reviewed, 457
Hatfield, A. W. on "Flowers that bloom in the Summer," reviewed, 372
Hatfield, Audrey Wynne, on "Flowers to know and grow, reviewed," 491
Hay, Roy, on Better Hedges, reviewed, 491
Hay, Roy, and F. A. Mercer, on "Gardens and Gardening," reviewed, 296
Hay, T., 237, 248, 249, 303
Headfort, Lord, 320
"Hearts-Ease, Herbs for the heart, the ductless glands and the nerves, reviewed, 215
Hedges, Better, by Roy Hay, reviewed, 491
"Hedges for Farm and Garden," by J. L. Beddall, reviewed, 295
Hedychium Gardnerianum, 329
Hedysarum coronarium, 315
humile, 445
Helianthemum frigidulum, 452
pannosum, 480
Helichrysum petiolatum, 423
Helleborus colchicus, 61
corsicus, 5, 61, **277**, 321
foetidus, exhb., lix, 447
Niger (Christmas Rose), 5, 61
altifolius, 61
orientalis, 61
purpurascens, 149
viridis, exhb., lxxvi
Hellyer, A. G. L., on "Utility Garden for Home Needs," reviewed, 296
Hemerocallis Forrestii, 226
nana, 226
plicata, 226
seedlings No. RC/A and CR/A, exhb., selected for trial, xcviii
Hemitarsonemus, 70, 71
latus (Banks) Ewing, **67**, 69
tepidariorum, 70
HETP (or Mortopal), 397
Herbaceous Rock Garden Plants: Some Introductions from the Himalaya and S.W. China, by W. G. Mackenzie, 221
Hewlett, M. Ann, B.Sc., and D. E. Green, M.Sc., A leaf spot diseases of Cineraria (Senecio cruentus) new to Great Britain, 199
Heywood, Vernon, H., B.Sc., Plant Collecting in the Mountains of Andalucia, 444, 478
Hibbertia volubilis, 464
Hibiscus Coeleste, 18
rosa-sinensis, 301, 339
Snowdrift, 18
syriacus, 18, 340
elegantissima, 18
var. totus albus, 340
Woodbridge, exhb., vii, 18, **27**
Hicks, Dr. John H., 190
Higgins, Vera, "The Cactus Growers Guide," reviewed, 369
"Highlands, A Hundred Years in the," by Osgood Mackenzie, reviewed, 168
Hills, Mr., 275
Hills, Lawrence D., on "The Propagation of Alpines," reviewed, 491
Hippeastrum bicolor, 285
crocatum, 360
equestre, 21
fulgidum, 360
× gracilis, 360
hybride × H. rutilum, 361
Incarnadine, exhb., lxxxvi
Johnsonii, 360
pardinum, 360
Pradham, exhb., lxxxvi
pratense, 285
procerum, 20
reginae, 360
reticulatum var. striatum, 361
rutilum, 361
var. fulgidum, **A.M.** March 7, 1950, exhb., lxiii, 334
× hybride, 361
Scarlet King, exhb., lxxx
vittatum, 360
× H. reginae, 361
Hippeastrum × gracilis, by J. F. Ch. Dix, [360
Hippophae rhamnoides, 59
Hirst, S., 70, 71
Hogg, Thomas, 389
Hoheria populnea, exhb., cii
Holboellia latifolia, 329
Holcus mollis, 246
Holodiscus discolor, 16
Holttum, R. E., on Horticulture in Singapore, 363
Honeysuckles, summer-flowering, 13
Hoog, Thomas, on A New Gloriosa (G. Verschuurii), 22
Hooker, Sir J. D., 23, 162, 163, 165, 167, 223, 302
Hopkins, W. B., 7
Horticultural Industry, present-day problems of, by F. A. Secrett, C.B.E., F.L.S., V.M.H., 175, **192**, **193**
"Horticultural Notebook, Newsham's The," reviewed, 459
Horticulture in Singapore, by R. E. Holttum, 363
Hortus Veitchii, 167
Host Plants, 70
Hosta albo-marginata, ix
crispula, ix
(Funkia) glauca, 246
lancifolia, ix

JOURNAL OF THE ROYAL HORTICULTURAL SOCIETY

Vol. LXXV Part 12

December 1950

THE SECRETARY'S PAGE

ANNOUNCEMENTS—DECEMBER AND JANUARY

Shows

TUESDAY, December 5 12 NOON to 6 P.M. WEDNESDAY, December 6 10 A.M. to 5 P.M.	Fortnightly Show. Late Apple and Pear Competition.
TUESDAY, January 23, 1951 12 NOON to 6 P.M. WEDNESDAY, January 24, 1951 10 A.M. to 5 P.M.	Fortnightly Show.

Lectures

TUESDAY, December 5 at 3 P.M. "Horticultural and Botanical Illustration" by MR. W. BLUNT.

TUESDAY, January 23, 1951, at 3 P.M. "Snowdrops and Snowflakes" by COLONEL F. C. STERN, O.B.E., M.C., F.L.S., V.M.H.

A programme of lectures is being arranged for 1951 and their subjects and dates will be given in the JOURNAL both in the preceding and in the current months.

Annual General Meeting—The Annual General Meeting to receive the Report of the Council for 1950 and a statement of accounts for that year will be held on Tuesday, February 20, 1951, at 3 P.M. in the Lecture Room of the New Hall. There will also be a show on that and the following day.

Orchid and Fruit and Vegetable Committees—There will be a meeting of the Society's Orchid Committee and Fruit and Vegetable

Committee on January 9, 1951, and Fellows and others are invited to submit novelties to those Committees on that date.

Wisley Gardens—Fellows are reminded that Wisley Gardens are closed on Sundays until March 4, 1951, though they will be open on all weekdays except Christmas Day.

Examinations 1950—At the Examination for the National Diploma in Horticulture with Honours the following three candidates were awarded the N.D.H. (Hons.):—

MISS MARY GATECLIFF
MR. FRANK SHAW.
MR. JAMES GEOFFREY CARRINGTON.

At the Final Examination for Teachers of School Gardening there were 21 candidates, of whom six obtained the certificate, as follows :—

MR. ERNEST JAMES DAVIES
MR. SAMUEL LESLIE SANDS
MR. AUBREY EDWARD ORFORD
MR. ALBERT TAYLOR TELFORD
MR. HORACE FREDERICK RALPH
MR. HARRY WALLER.

The Society's Examinations—Candidates who wish to enter for the Society's Examinations in Horticulture in 1951 are reminded that the closing dates for entry forms are as follows:—

General Examination in Horticulture, and General Examination in Horticulture for Juniors—Monday, January 15, 1951.

Examination for the National Diploma in Horticulture (Preliminary and Final) and N.D.H. (Honours)—Thursday, February 1, 1951.

Examination for Teachers of School Gardening (Preliminary and Final) Friday, April 27, 1951.

Conference on the Breeding of Garden Plants—It is planned to hold a Conference on the Breeding of Garden Plants on Tuesday and Wednesday, July 10 and 11, 1951. This Conference will be held in conjunction with the Society's Fortnightly Show. Papers will be given by leading experts, one on the afternoon of Tuesday, July 10, and two on the morning of Wednesday, July 11. There will be a discussion on Wednesday afternoon in which eminent plant breeders will participate. On Thursday, July 12, one paper will be given in the morning and one in the afternoon. On Friday, July 13, a day excursion has been arranged to the JOHN INNES HORTICULTURAL INSTITUTION at Bayfordbury, possibly extended to prominent establishments in the district. On Saturday, July 14, a day excursion has been arranged to the Society's Gardens at Wisley and to MESSRS. SUTTON's Trial Grounds at Reading and Slough. Programmes may be obtained later from the Secretary.

Publications—A leaflet giving a list of new publications issued by the Society was included in the November JOURNAL. It is requested that Fellows complete the Order Form enclosed for such publications as they may require in good time before Christmas.

WISLEY IN DECEMBER

IN this season, visitors' attention will naturally be directed almost entirely to the greenhouses and they are sure to find much that will interest them there.

The Stove House is mainly devoted to Orchids, but in the first section there is a general collection of stove plants, including a group of Poinsettias arranged round a small central tank. The upper whorls of leaves constitute the showy part of this plant and vary from pink, flame and scarlet to white. They require as much light as possible and an even temperature of not below 60° F. *Plumbago rosea* makes another very good pot plant for this season. The phlox-like flowers are borne in numerous terminal spikes and are of an attractive shade of salmon-pink. Contrasting in colour with these are plants of *Coleus thyrsoideus*, one of the best of the ornamental-flowered group, carrying large Gentian-blue spikes. There is a fine specimen of that somewhat rare plant *Agapetes macrantha*. The flowers are urceolate, very thick and waxy, pinkish-white strongly veined with crimson and hang in large umbels from thin twining stems, but it is not the quantity of flower but the strange veining which makes the plant such an arresting spectacle. Trained up the roof-supports is *Clerodendron Thompsonae magnificum* carrying hanging flowers with creamy-white calyx, crimson petals and long exserted stigma. Turning to the Orchids, the Cypripediums are flowering well, as are the first Cattleyas and *Angraecum distichum*, whose hanging white-flowered racemes smell strongly of vanilla. The genus Calanthe is one of the most useful and popular groups of Orchids as it supplies an uninterrupted succession of flowers during the winter months. One of the most valuable is the carmine-flowered *Calanthe Veitchii*, a hybrid between *C. rosea and C. vestita*. The first hybrid to be obtained in the Vestitae section, it was raised by DOWNING at MESSRS. VEITCH'S nurseries in Exeter in 1856. There is also the similar, but white-flowered, *Calanthe Harrisii* to be seen. There are few Orchid collections in which *Trichosma suavis* is not represented, and this is no exception. It is a monotypic genus separated from Coelogyne on account of having stems which are not thickened into pseudo-bulbs, and eight pollinia instead of four as in Coelogyne. It was discovered by GIBSON in 1836 in the Chirra district of the Khasia hills where it grows on trees. In cultivation it requires cool treatment to produce the racemes of small fragrant white flowers with their distinct maroon-streaked centres.

In the Temperate House the blood-red clustered flowers of *Malva umbellata*, the six-inch long light orange racemes of *Buddleia madagascariensis*, one of the most widely known plants on the French Riviera, and near by, the similarly coloured *Cestrum aurantiacum*, form bright patches of colour. Species of Epacris were once among the most valued of winter flowering plants, but are seldom seen to-day. *E. impressa* is one of the best and incidentally one of the hardiest, producing three to four foot-long spikes of pink heather-like flowers over a long period. A number of plants are decorating this greenhouse intermingled with *Erica canaliculata*, the flowers of which will last in beauty for about two months. It is a superb plant when grown out of doors, as it can be in the west of England, where it reaches a height of over ten feet with

enormous spires of white translucent flowers and purple anthers giving the flowers a shadowy appearance. The pure white blooms of *Erica Veitchii*, sweetly hawthorn-scented, are freely produced. It is a chance hybrid between *E. arborea* and *E. codonodes* but without the latter's pink tones in the bud. Those who appreciate pretty detail among plants will be interested in *Fuchsia procumbens*, a prostrate, trailing plant set with scarlet fruits like small Cherries. *Camellia japonica* 'Magnoliaeflora' is covered with pale pink blooms, and *C. Sasanqua fragrans*, with white, cup-shaped ones; *C. japonica* 'Adolphe Audusson' has double carmine flowers, and *C. j.* 'White Swan' combines perfect form with snowy whiteness. Two Rhododendrons are also flowering extremely well, *R.* 'White Wings' and *R. mucronatum*. *Eupatorium micranthum* is not a very distinguished plant, but nevertheless forms a well-shaped shrub with neat evergreen leaves and foamy clusters of white flowers. From the coastal sand dunes of New South Wales and Queensland comes a good climber, *Hibbertia volubilis*, with large butter-yellow flowers and bronzy young growths. A good specimen of a scarlet-flowered Bottle-Brush, *Callistemon speciosus*, is flowering well. It makes a superb pot plant, being decorative even when not in flower on account of its neat habit and blue-grey leaves. It is often sold under the erroneous name of *Metrosideros floribunda*.

In this house there is only a small collection of succulent plants, but one which contains representatives of a large number of genera. Most of the Aloes are too large to be grown in the average collection, but there are one or two which are worth trying. *Aloe aristata* flowers freely in cultivation and appears to be almost hardy in sheltered positions. *A. brevifolia* is an attractive species with thick glaucous leaves armed with stout teeth. *A. arborescens* makes a tall stem but takes some years before becoming very large. The Bryophyllums come chiefly from Madagascar. *B. Daigremontianum* is a handsome species with flat thick leaves marbled with purple on the undersides, notched along the edge, and at each notch a small plantlet is produced. The flowers are pinkish-buff, borne in large terminal heads. The Faucarias were at one time included under the heading of Mesembryanthemum, a group which has now been divided into over a hundred different genera. There are several species represented here, the most popular being *F. tigrina*, known as Wolf's Chaps on account of the strongly developed teeth on the margins of the leaves. This plant has particularly fine yellow flowers. In addition, numbered among those in the collection are Haworthias, Gasterias, Glottiphyllums and species of Echeveria.

In the Half Hardy House are a few plants which make a brave show throughout the winter months. Notable among them is *Lithospermum rosmarinifolium* with deep gentian-blue flowers, *Cuphea micropetala* and the dwarf Mexican *Fuchsia microphylla* with small, deep pink flowers. *Fascicularia bicolor*, a plant infrequently seen in cultivation, occasionally produces dense heads of greeny-blue flowers in the midst of a rosette of rigid linear spiny leaves, those surrounding the flowers being stained brilliant scarlet in the lower third. Like the above, *Puya alpestris* is a Chilean plant and of similar form. The grey-green leaves are strongly recurved and set with hooked spines.

MASTERS MEMORIAL LECTURES, 1950

THE ORIGIN AND IMPROVEMENT OF CULTIVATED PLANTS

M. B. Crane, F.R.S., A.L.S., V.M.H.

JOHN INNES HORTICULTURAL INSTITUTION, BAYFORDBURY, HERTFORD, HERTS.

PART II

(DR. H. V. TAYLOR, C.B.E., V.M.H., *in the chair*)

The Induction of Polyploidy

THE crossing of distantly related plants has been done ever since the discovery of sex in plants, in order to bring desirable characters together. This is not difficult, but, like the Cherry Plum × Sloe crosses, described in my last lecture, the normal hybrids thus created are usually sterile and hence often of little value. In contrast the double hybrids with twice as many chromosomes are highly fertile and productive. In brief, the sterility in the normal hybrids is due to the inability of the chromosomes to pair; in the double hybrid the doubling of the chromosomes provides identical sets which readily pair and in this way the plant functions as a diploid and fertility is restored.

In the past we have had to await the rather rare "accident" of spontaneous chromosome doubling for the restoration of fertility and the production of desirable new forms. It is at this point, by providing the plant breeder with new tools with which he can induce "accidents" of this kind at will, that comparatively recent discoveries are lending a hand. One such tool, amongst others, is the discovery that the drug colchicine, when suitably applied to plants, will induce chromosome doubling. For producing polyploid plants by the use of such drugs, treatment of dormant or relatively inactive tissue is least effective. It is probably due to this that, so far, success has been mainly obtained by treating plants with relatively soft tissues which produce new growths freely and rapidly, e.g. annual or herbaceous plants such as Antirrhinum, Marigold, Tomato, Oenothera, Tradescantia, etc. The aim of the treatment is to induce chromosome duplication in the cells of the growing point, i.e. those cells which will develop into a new shoot, and the best results are obtained by early treatment such as on germinating seeds or young seedlings or young shoots. The usual method is to soak germinating seeds or young shoots in a weak solution of colchicine or to apply drops to the growing point of a seedling or young branch, and since the drug is most effective when there is active cell division it is important to encourage rapid growth. Sometimes this can be achieved in plants which are normally slow-growing by removing the seed coat and growing them at higher temperatures. For example, with Apples and Pears, my colleague, DR. P. T. THOMAS, obtained the best result by dissecting out the embryo of seeds freshly removed from the fruit before treatment. Where treatment has been effective, growth is temporarily

stopped and the root tips become swollen or bulbous (see Fig. 236). With such material the aim should be to select the most retarded plants and nurse them back to normality by growing them in a moderately high temperature and under moderately humid conditions. The seedlings shown in Fig. 231 were treated in a 0·05 per cent. solution of colchicine and the photograph taken twenty-four hours after treatment. Fig. 234 shows a normal diploid cell of an Apple with thirty-four chromosomes and a tetraploid cell with sixty-eight, the result of colchicine treatment, and Fig. 232 is the Radish variety 'Scarlet Globe'; on the left normal diploids, and on the right induced tetraploids. Although colchicine can be used on all kinds of plants it is probable that its most valuable use lies in the restoration of fertility in hybrids.

My colleague, DR. D. LEWIS, 1943, has used a different and novel method for producing polyploids by the use of heat shocks and by what he calls the incompatibility sieve. The heat shock, 45° C. for one to two hours, is given to branches of fruit trees at the early stages of germ-cell formation by means of a thermostatically controlled heating cylinder. This gives rise to a proportion of unreduced diploid pollen grains. The resulting mixture of haploid and diploid pollen is then applied to incompatible styles, in which only the diploid pollen functions, thus giving triploid seedlings. In this way triploid types of 'Beauty of Bath,' 'Northern Spy' and 'Cox's Orange' Apples, and 'Fertility' and 'Conference' Pears have been produced.

Another simple method for inducing polyploids can be used in some plants. It is the decapitation method, where young and rapidly growing plants are cut through at an internode. A callus is then encouraged to form on the cut surface, and from this buds and shoots differentiate as shown in the Tomato plants in Fig. 233. About seven per cent. of the shoots formed in this way are tetraploids; such shoots can be distinguished by their sturdier growth and are readily propagated vegetatively.

X-rays have been, and are continuing to be extensively and successfully used, for chromosome rearrangement and the induction of mutations.

The Action of Genes

In my previous lecture I referred to some of the more obvious ways in which genes take part in the determination and inheritance of the characters of plants, such as the colour of flowers, habit of growth and so on. But they control numerous characters and processes in plants which are not so readily apparent. Thus sexual incompatibility which is common in fruit trees and a phenomenon widespread throughout the plant kingdom is determined by genes. In the wrong, *incompatible*, combination they prevent the pollen-tubes from growing down the styles and effecting fertilization, and hence no seed or fruit is formed. In the right, *compatible*, combination, however, the pollen-tubes travel the length of the styles, fertilization occurs and seed and fruit is freely formed. In the Raspberry genes determine whether the flowers are hermaphrodite or whether one or the other of the sexes are absent, thereby giving plants which are entirely male, or plants which are female.

The action and cumulative effects of genes are well illustrated by investigations carried out in America by MANGELSDORF and FRAPS (1931) relating to the number of genes for pigmentation in the cells of the endosperm and the amount of vitamin A in the seed of Maize. As in most angiosperms, the endosperm of Maize results from a sexual fusion in which two maternal nuclei combine with one male nucleus. Hence in respect of yellow pigmentation, the cells of the endosperm may have none, one, two or three genes for yellow pigment with the corresponding genetic constitution yyy, yyY, yYY, YYY. The four classes are approximately white, pale yellow, dilute yellow and deep yellow respectively. By making the appropriate pollinations these four classes of seeds were obtained, and their vitamin assay determined in two successive years. The results obtained showed a high degree of association between the number of Y genes present in the endosperm and the number of units of vitamin A per gram of seeds. The average results for the two years were as follows :—

No. of genes for yellow	Genic composition of endosperm	Units of Vitamin A per gram		
		1928	1929	Average
0	yyy	0·05	0·05	0·05
1	yyY	2·50	2·00	2·25
2	yYY	5·00	5·00	5·00
3	YYY	7·00	8·00	7·50

These results show that a white-seeded variety of Maize, the endosperm of which ordinarily has little or no vitamin A, is capable of forming this substance in its seeds if the gene for yellow pigmentation is introduced, the only difference in the seeds being the microscopic pollen nuclei which entered to produce the endosperm. They also show that there is a direct quantitative relationship between the number of genes for yellow in the cells of the endosperm and the amount of vitamin A in the seeds, each gene for yellow inducing approximately 2·5 units per gram of seed.

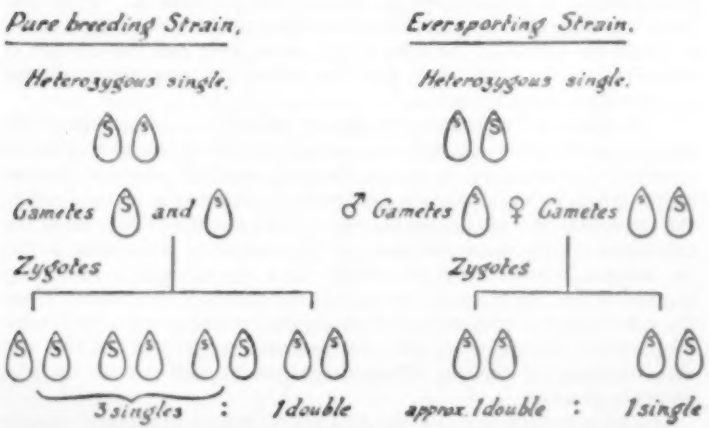
The units of inheritance are almost entirely contained within the nucleus of the plant-cell, and are carried over from one generation to another in the nuclei of the germ-cells and in normal crosses it does not matter which is the female; the reciprocal crosses are the same. Usually the cytoplasm and its inclusions, which comprise the remainder of the cell contents, play no conspicuous part in inheritance. Exceptions to this are known, however, and in certain cases the cytoplasm itself may transmit a definite character or modify the action of the genes. Thus, there is a yellow-leaved form of *Primula sinensis* which, when pollinated by green-leaf forms, gives only yellow-leaved progeny in the first and all subsequent generations. When the reciprocal cross is made the progeny are all green.

In some cases a gene, or group of genes, behave differently according to the way they are associated with the cytoplasm from one plant to

another. For example, in a cross between procumbent and tall forms of flax, *Linum usitatissimum*, a gene, or genes, associated with the cytoplasm from the tall parent give hermaphrodite plants, having both male and female organs on the same flower, whereas the same gene, or genes, associated with cytoplasm from the procumbent parent gives female forms. Similar examples of extra-nuclear inheritance are known. They are most common in reciprocal hybrids between species.

In many species of plants double flowers are a feature of horticultural varieties. Doubleness is rarely simply inherited; at one time the evidence was that in *Tropaeolum* the double flower character was a simple recessive to single flowers. But more detailed investigations have shown that more than one gene is involved and that different degrees of doubleness occur. In addition there is a super gene for double flowers which is dominant.

The inheritance of double flowers in the the Ten Week Stock, *Matthiola incana*, is complex and has for long intrigued both the seed grower and the horticulturist. In this race of Stocks there are singles which are homozygous SS and hence give only single flower offspring. Singles which are heterozygous Ss and give 3 singles to 1 double, and then there is the so-called ever-sporting strain in which the singles give approximately 1 single to 1 double and this is the strain which is mostly grown in our gardens (see Text Fig. 1). One frequently hears of Stocks giving a much higher proportion of doubles than 50 per cent.; this I think came about in two ways (1) seeds which give rise to singles appear to be less viable than those which give doubles and in this way old seed may give a higher proportion of doubles than the expected equality. (2) In some Stocks in the seedling stage doubles are larger and more robust than singles and hence there may be selection, conscious or unconscious, for double flowering plants. By such selection over 90 per cent. of plants with the desired double flowers have been obtained.



Text Fig. 1.

In the Carnation doubleness is a character of practically all commercial varieties. The single Carnation usually has five petals while at the other extreme the full doubles have a petal number of over three hundred. Horticulturally these very full doubles are not attractive. They do, however, produce good pollen. Hybridization of these two types produces the commercial standard double, i.e. the intermediate semi-double with forty to sixty petals. Thus these commercial Carnations are unfixed hybrids of a non-dominant constitution.

In the Dahlia, Chrysanthemum and many other flowers the inheritance of doubleness is quantitative and complex and between the single and the full double flower all degrees of doubleness occur.

Although exceptions occur, it is common to find a more complex and wider range of variation in polyploid plants, especially in high polyploids, than in diploids; compare, for example, the variation within the diploid *Prunus cerasifera* and the tetraploid *Prunus spinosa* with that in the hexaploid garden Plum *Prunus domestica*, also the variation within the tetraploid species of *Dahlia* with that of the octoploid garden *Dahlia variabilis*. Again, variation, is commonly discontinuous in diploid plants, but in polyploids it is more often of a continuous nature, owing to the presence of a greater number of gene differences. Where two or more genes govern the expression of the same characters, as is common in polyploids, their effect is often cumulative, and consequently a given character may intergrade from one extreme to the other. Although new forms which arise from interspecific hybridization and chromosome duplication often reproduce themselves as new and constant types, great variation may subsequently occur as a result of the recombination and interaction of the many different genes brought together. In this connexion those who induce polyploids of this kind should remember that the new induction may be only the beginning and not the end of possibilities.

The kinds of complications to which I have referred above, I feel, have frequently led practical breeders of horticultural plants to become suspicious of genetics and even to doubt the truth of the Mendelian theory of heredity. The simple ratios and simple laws of inheritance they have been led to expect, as a result of the early investigations with diploid plants, such as the Sweet Pea and Primulas, did not seem to apply to such plants as Dahlia, Chrysanthemum, Carnation, Plum and Apple. The phenomenon of dominant and recessive characters was often obscure, and simple segregation was not always evident. However, as I have pointed out, in the case of polyploids where a number of cumulative and differential genes may govern the same character, the expression of dominance is essentially more variable. In addition those who breed the plants I have just mentioned, should remember that they are invariably using varieties which are maintained vegetatively and hence may be complex and extremely heterozygous.

Hybrid Vigour

To review in detail the different ways by which the high yield and other outstanding qualities of our leading horticultural varieties have been obtained would take a long time, but breeding and selection have

played major parts. In most cases, of course, this has only been achieved after many years' work, but in recent times a short cut has been taken to crop improvement.

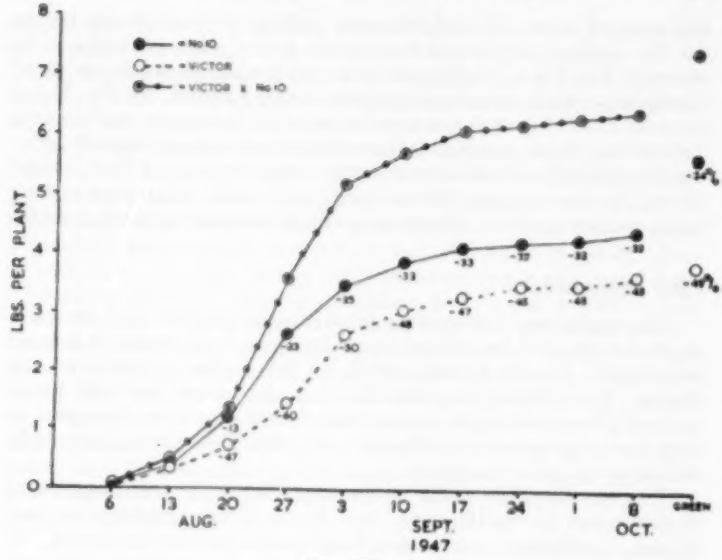
When two inbred strains or varieties of plants are crossed together it commonly happens that the first hybrid generation is more vigorous than either of its parents. Often this hybrid vigour is accompanied by a higher yield and other advantages, and in plants so diverse as Maize and forest trees this hybrid vigour has been used with profit and success. In Maize it has been utilized in America on a gigantic scale, and a number of hybrid strains have been introduced for general cultivation both from experimental stations and from commercial seed companies. In pre-war, up to 1939, the average yield of Maize per acre in U.S.A. was 25 bushels, whereas by using hybrid vigour the average yield in 1948 was 42·7 bushels, an increase of over 70·0 per cent. (HAINSWORTH, 1949); and during the period 1946–48 the U.S.A. produced more than 3,000,000,000 bushels of Maize annually. In addition to taking a major part in this enormous increase in yield, hybrid generations have been found which are more uniform, and more able to withstand drought, wind, disease and other unfavourable conditions than the best standard varieties. Though the old kinds have to be retained, this type of Maize, raised anew each year from controlled crossing, has therefore almost displaced the older standard kinds from cultivation.

In breeding experiments with *Sorghum*, KARPER and QUINBY (1937) obtained different degrees of hybrid vigour, and they state: "It follows that the different degrees of vigour obtained represent differences in the number of dominant genes favourable to growth, and that the effect of these genes, though small individually, is cumulative. More specifically, it is apparent that certain genes affect the ability of the plants to tiller, certain others affect the number of nodes, others size of leaf etc." In the maximum hybrid vigour lines in *Sorghum*, an increase in the yield of grain over twice as much as that of the higher yielding parent was obtained.

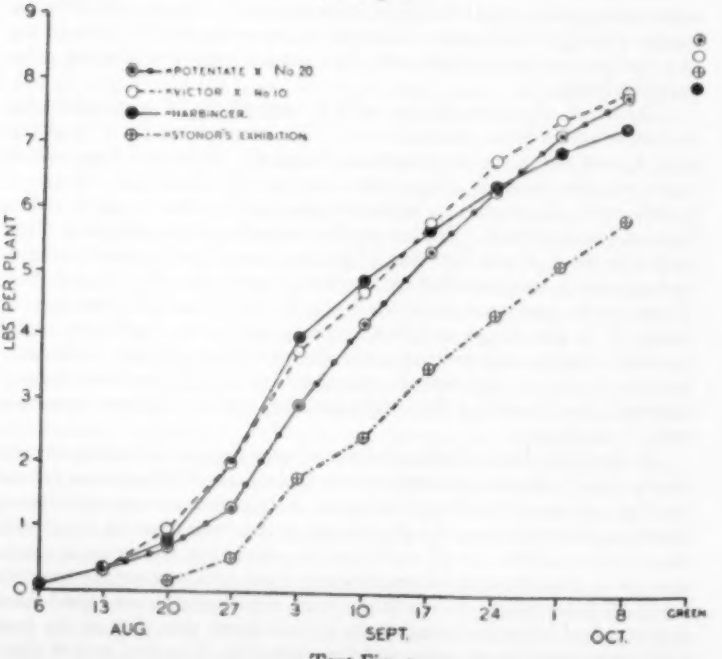
In horticulture hybrid vigour is only just beginning to receive direct attention, but in certain crops it has been unconsciously utilized for centuries. Many of our asexually propagated crop plants have been selected for vigour of growth, high yield, etc., which are to a large extent the result of hybrid vigour. Among such plants are Potatoes, Apples, Pears, Strawberries and Raspberries. Hybrid vigour in these is evident from the fact that they invariably lose much of their vigour when inbred, but the vigour is, of course, maintained in varieties of these crops by the horticultural practice of vegetative propagation; that is, of course, as long as they are free from the inroads of virus and other troubles.

In some American seed catalogues hybrid lines of Tomatoes and Cucumbers are described. At Bayfordbury we are investigating the possible utilization of hybrid vigour in Tomatoes and in some hybrid generations a considerable increase in yield of fruit has been obtained beyond that of either parent (see Fig. 235 and Text Figs. 2 and 3), but the refinements which are esteemed in this country, such as a medium size and uniform shape of fruit, require further investigation.

In these experiments the Tomatoes have been grown out-of-doors



Text Fig. 2



Text Fig. 3

and stopped at the fifth inflorescence; picking of ripe fruit was begun the first week in August and finished the second week in October. As shown in Text Fig. 2, by that time the hybrid line had given two pounds of ripe fruit per plant more than its highest yielding parent. In Text Fig. 3 the same hybrid line is shown with the varieties 'Harbinger' and 'Stonor's Exhibition.' In experiments we have carried out with established varieties 'Harbinger' has been outstanding for early ripening and 'Exhibition,' though late ripening, has been outstanding for yield, and in these experiments we now use them as a measure of earliness and yield respectively.

Plant Improvement

During the past three or four decades much progress has been made in the breeding of agricultural crops for specific purposes. A notable achievement was the breeding of Bread Wheats for resistance to rust disease. Considerable breeding has been also carried out with horticultural plants and crops in an attempt to combine such characters as early maturity, resistance to disease, etc., with high quality, high yield and other desirable characters.

Progress has been made in breeding Asters for wilt disease and Antirrhinums for resistance to rust. In the Potato immunity to wart disease, *Synchytrium endobioticum*, is a feature of all recently introduced varieties, and some are resistant to blight, *Phytophthora infestans*. Inheritance of resistance to blight is complicated owing to the different strains of blight which exist. Different races, or strains, likewise appear to occur in the Antirrhinum rust, Tomato leaf-mould and many other parasitic fungi.

The work of BLACK (1947) with Potato blight is particularly informative and of great practical value. The common strain of blight he calls A, and two more recent strains B and C. Although B and C are more virulent than A, they differ qualitatively from each other. A fourth strain, D, appears to be slightly less virulent than C and it differs from it quantitatively. Studies on the inheritance of resistance show that, with the A, B and C strains, blight resistance behaves as a dominant, and appears to be controlled by four major genes, Ra, Rb, Rc and Rbc. These confer resistance from strains A, B and C and all three respectively. It is also concluded that minor genes act as modifiers in the resistant varieties and determine the degree of susceptibility in the susceptible varieties. Apparently resistance to blight has been largely obtained from breeding the blight resistant species *Solanum demissum* with *S. tuberosum*.

At the John Innes Institution we are carrying out breeding experiments with Tomatoes for resistance to leaf-mould, *Cladosporium fulvum* (see Fig. 236), and have found that some of the older resistant varieties are dominant for resistance, the F_1 families raised from crossing them with susceptible varieties are all resistant. In others the resistance is recessive the F_1 families raised from crossing them with susceptible varieties being all susceptible. In our early work the resistants we raised were characterised by rather small fruit, a yield lower than that of the best yielding susceptible varieties, and late maturity. The first two of these

defects have been overcome and the work is being continued to attempt to obtain early ripening of the fruits combined with resistance.

In the Peach, *Prunus persica*, it has long been known that varieties without glands on their leaves are highly susceptible to mildew, whilst varieties with glands are extremely resistant.

In *Prunus persica* there are of course varieties with hairy fruits, Peaches, and varieties with smooth fruits, Nectarines. The hairy character of the fruits is dominant and the smooth character recessive. In both, varieties occur with glands on the petioles of their leaves, some with small globose glands and others with large reniform glands. The eglandular and the reniform glands are homozygous and breed true. Crossed together they give globose glands, and if these are selfed they give a ratio of 1 : eglandular, 2 : globose glands, 1 : reniform glands. Both the globose and reniform gland individuals are highly resistant to mildew. Fig. 237 shows on the right-hand side a family raised from selfing the Peach 'Royal George,' a variety without glands, and on the left a selfed family raised from the Nectarine 'Lord Napier,' a variety with reniform glands. As shown in the photograph the 'Royal George' family were all badly affected with mildew; in this experiment no spraying to control the disease was carried out and eventually they all died owing to the severity of the attack.

In contrast, the majority of the 'Lord Napier' family were entirely free from mildew, although many branches of two families were interlaced. There were twenty-eight individuals in this family and only on two was mildew observed, and on these the attack was very slight and confined to a few young terminal leaves towards the end of the growing season. In the large Peach growing areas of the world varieties with glandular leaves have almost entirely displaced eglandular varieties.

For many years, in conjunction with the East Malling Research Station, I have been interested in the resistance of the Apple to the woolly aphis, *Eriosoma lanigerum*, possessed by the variety 'Northern Spy.' In families raised from crossing this variety with a number of the susceptible clonal root-stocks, both highly resistant and susceptible seedlings occurred (see Fig. 239). The hereditary behaviour of resistance to the woolly aphis is complex and in several respects exceptional. Seedlings in the same family grade from high susceptibility to complete resistance. Some crosses between susceptible and resistant gave all susceptible offspring. At the other extreme, the highest proportion of resistant seedlings, 47 per cent., was obtained by crossing susceptible with resistant, whereas 33 per cent. was the highest proportion of resistants obtained from crossing resistant with resistant. These results show that the susceptible forms are genetically of different kinds; some possess genes concerned with resistance, others do not. The resistants are also of different kinds; some have a higher value in respect of the hereditary transmission of resistance than others.

At the John Innes Institution we are carrying out breeding experiments with dwarf and bush varieties of Tomatoes. Fig. 238 shows the early ripening variety 'Puck' which combines the sturdy growth of the variety 'First-in-the-Field' with the bush habit of the variety 'Victor.'

More recently we have obtained a more compact and a more early ripening form of 'Puck.'

In this lecture I have given some account of the making of polyploid plants, the action of genes, and examples of plant breeding and plant improvement. To attempt a complete survey of the achievements of plant breeding would be beyond the scope of this lecture; much improvement has been made in many of our garden decorative plants and flowers and in this improvement breeders have taken advantage of new mutations, new polyploids and also of newly introduced species. Apart from outstanding achievements it is worthy of note that in our economic crops even a slight improvement, whether by reducing the high cost of spraying for the control of disease, or by increasing quality or yield, may amount to a huge sum in the economy of a nation.

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THE "ORTO BOTANICO," PADUA

Hugh Farmar

PADUA has many claims to fame. The University, founded in 1222, was renowned throughout Europe from the Middle Ages onwards, and still keeps its pre-eminence as the mother of Italian medicine. There are the Giotto frescoes, those of Mantegna sadly bomb-scarred, and DONATELLO'S marvellous equestrian statue, the Gatamelata, in front of the many-domed Cathedral. But very few visitors, when they have seen these wonders, explored the arcaded streets and made their wish at St. Anthony's shrine, discover that there is also a treasure of equal, if not greater, interest tucked away in a side-street behind the Cathedral square.

The Orto Botanico lies at the end of a cul-de-sac and, in order to reach it, one crosses a little sixteenth-century bridge which spans what was once a brook and is now a dry ditch except in the winter rains. Yet, even when one has reached the entrance, the Garden remains sequestered behind its high surrounding wall.

At first sight the plan of the Garden appears to be simple. The circular wall is pierced at the four corners of the compass by gates with tall piers surmounted by handsome urns holding wrought-iron flowers. There are the Crown Imperial (so favourite a flower in the seveneenth and early eighteenth centuries), Madonna Lily, Pineapple and Yucca. From these gates four walks converge on a central fountain and, within the segments thus formed, are four inner square gardens surrounded by somewhat ugly iron railings. Each of these gardens in turn has a central octagonal basin and fountain; and the first impression is that the whole Garden was designed to single geometric plan, an illusion heightened by the presence of a number of trees which tend to obscure the subtlety of the conception. It is only on a closer view that the skill of ANDREA MORONI, a contemporary of PALLADIO and a famous architect in his day, becomes apparent.

None of the four gardens is in fact similar. Each is an essay in different geometrical patterns, though the practice of bordering the flower beds with deep narrow stones sunk to within a few inches of the ground is adhered to throughout. Except in the case of a modern pond, similarly divided so as to accommodate aquatics, the original sixteenth-century stones appear to be still in place.

The confined space of these four gardens has been most ingeniously used to obtain, not only the best effect architecturally, but also to give growing room for the largest number of plants. In one case the design is one of concentric circles of the tiny stone-bordered beds, in another one of a complicated series of triangles. Or again rectangular and elliptical beds are combined. Particular skill has been shown in filling up the corners of the square gardens and in graduating in size the concentric beds from those, comparatively large at the outside, to very small ones round the central fountain. (Fig. 243.)

Padua passed under the suzerainty of Venice in 1407 and, while she lost her importance as an independent state, she became the university city of the Venetians and benefited from the republic's greatest period of prosperity. The two cities were joined, as now, by the river Brenta and

a short passage across the lagoons. And, from the sixteenth century onwards, when the Venetian grandees were first permitted to own property on the mainland, the increasing traffic of barges and gondolas passed by a long series of splendid country houses from PALLADIO's classic Villa Malcontenta, with its huge portico reflected in the still green waters, to comparatively late baroque palaces where the patricians took their ease in the hot weather. It was said that none of the water diligences which plied between Venice and Padua was without a priest, a student and a courtesan. But, as we shall see, there can be no doubt that the barges also carried thousands of exotic plants and their seeds brought home in the Venetian argosies. While the commerce of Venice flourished, the Paduan Garden remained the prime recipient and distributor of an increasing treasure of plants new to Europe.

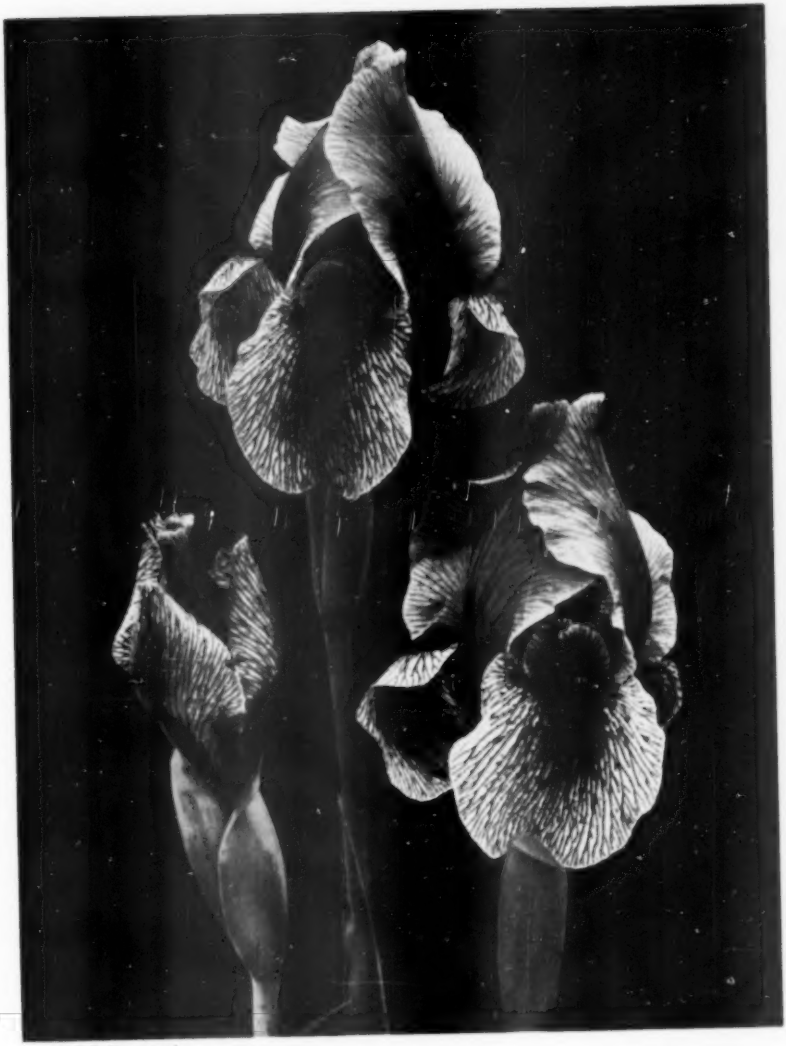
As in a number of other cases, the Garden at Padua began as a physic garden. The Venetian Senate had inaugurated a Chair of "Lectura Simplicium" in 1533, the first of its kind in universities, and appointed FRANCESCO BONAFEDE as its first occupant. Twenty years later a new branch, the "Ostensione dei Semplici," was developed; and from this branch grew all the modern schools, chairs and laboratories devoted to the study of nature. In 1543 BONAFEDE, dissatisfied with casually-collected specimens, represented the necessity of a public garden where plants, particularly exotics, could be studied, and for a modern physic garden. Eventually the Council of Prelates was prevailed upon to allocate a site near the Convent of Santa Giustina, and the construction of the Garden was confided to PIETRO DE NAOLE, a professor of medicine, and DANIELE BARBARO, who was later Patriarch of Aquileia. BARBARO was a keen horticulturist and possessed a flourishing garden in Venice.

The work of building the Garden was at once put in hand. Only a few years later the famous KONRAD GESNER affirmed that he had never seen a garden so full of plants or so well kept. It quickly became notable, and Padua's example was almost immediately followed by the universities at Pisa (whose garden is almost contemporary), Florence and other Italian states. Nevertheless, although the Paduan Garden remained tiny in comparison to some of its successors elsewhere, it kept its pre-eminence for a long period and will always be venerated as the first botanical garden established in Europe.

Before the middle of the sixteenth century there were few gardens in Italy where plants of interest were grown though, in Padua and Venice, a number of patricians were accustomed to collect rarities from other parts of Italy and from those countries, particularly the Levant, with which the Republic was linked by trade.

BONAFEDE's garden was at first devoted entirely to the study of simples and, when completed, it was given in charge of LUIGI SQUALERMO, called "ANGUILARA," who was nominated "Herbario," and "Professor of the Medical Garden at Padua." Out of the study of the medical properties of plants grew an interest in the plants themselves and, under ANGUILARA's direction, the Garden quickly attracted the attention of the historians of the time.

The late sixteenth-century was the golden age of Italian botany.



Photo, J. E. Downward

Fig. 230—*Regelio-Cyclus* Iris 'Teucros' **P.C.** May 23, 1950. Shown by Messrs. C. G. van Tubergen, Haarlem, Holland.

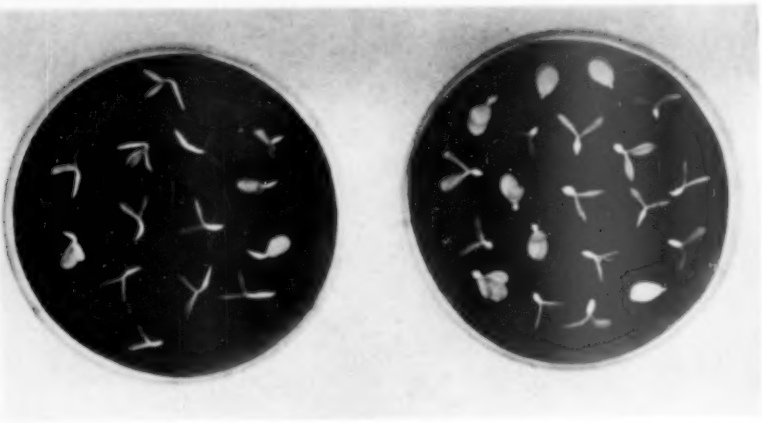


Fig. 231—(Right) Apple seedlings treated with colchicine. (Left) Control
(See p. 466)

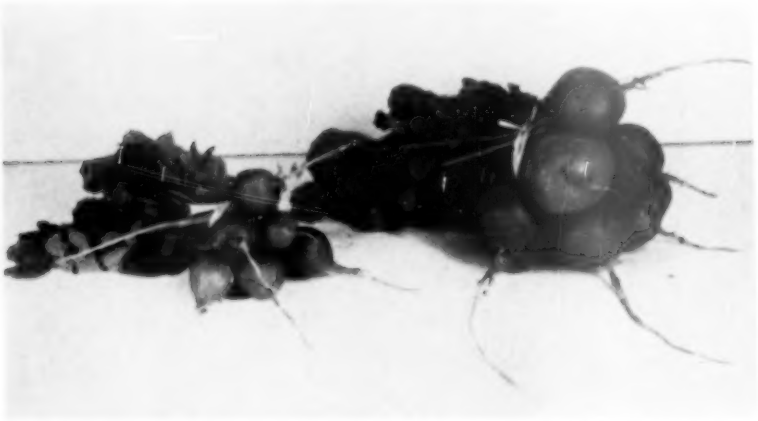


Fig. 232—Radish 'Scarlet Globe.' (Left) normal diploids. (Right) induced tetraploids (See p. 466)

Fig. 233—Decapitated Tomato plants with young shoots differentiating
(See p. 466)

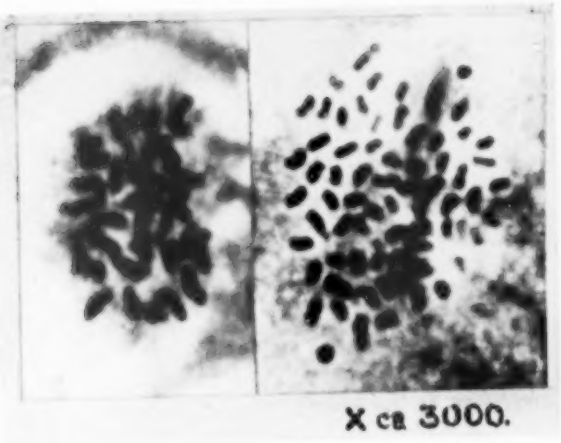


Fig. 234—(Right) a Tetraploid cell of an Apple with 68 chromosomes. The result of colchicine treatment. (Left) A normal diploid cell with 34 chromosomes (See p. 466)

Fig. 235—Tomato, F_1 line from the variety 'Victor' crossed seedling No. 10 (See p. 470)

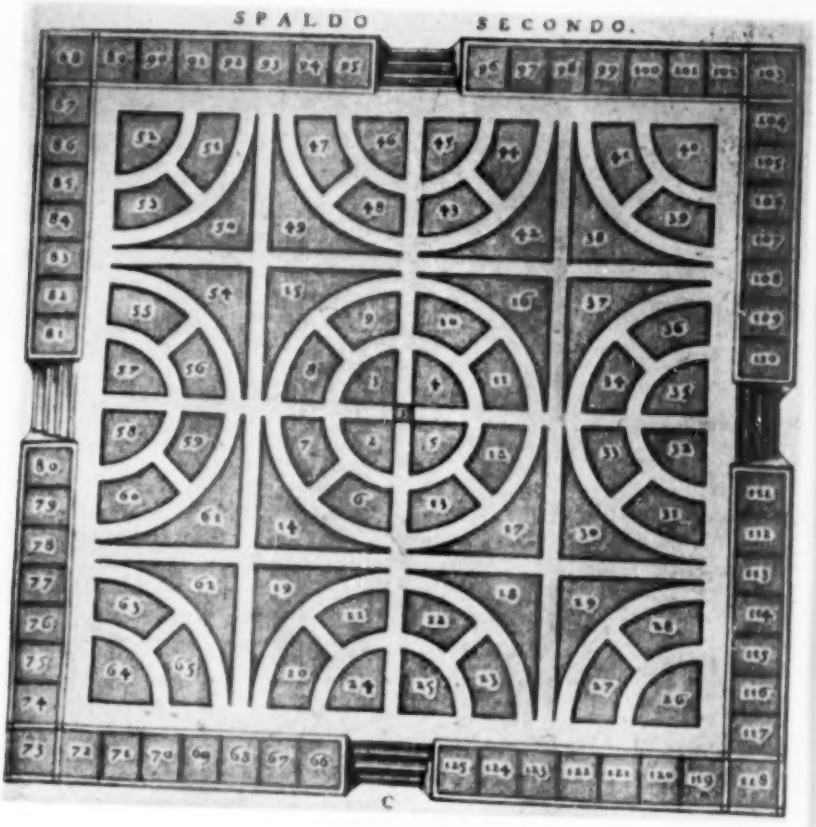
Fig. 236—Leaf-mould resistance in Tomatoes. (Right) the susceptible variety 'Ailsa Craig' heavily infected with leaf-mould. (Left) a family of resistant seedlings free from leaf-mould. (See p. 472)

Fig. 237—Peaches. (Right) a family without foliar glands badly attacked by mildew. (Left) a family with glands free from mildew (See p. 473)

Fig. 238—Tomato variety 'Puck' combining the sturdy dwarf habit of the variety the 'First-in-the-Field' and the bush habit of the 'Victor' (See p. 473)

Fig. 239—Apple Seedlings: (Left) immune; (Right) susceptible to Woolly Aphis. Raised from 'Doucin' susceptible, crossed 'Northern Spy' immune (See p. 473)

Fig. 240—The "Orto Botanico," Padua, from the *L'Orto Botanico* by Visiani, 1842 (See p. 475)



THE "ORTO BOTANICO," PADUA

Fig. 241—Plan of one of the four original gardens. The numbers correspond to blank spaces in the interleaved edition for students to fill in the names of the actual plants. From *L'Horto dei Semplici di Padoua* by Girolamo Porro, 1591

Fig. 242 — "Goethe's" Palm-house in the background (See p. 478)

THE "ORTO BOTANICO," PADUA

Fig. 243—One of the circular gardens (See p. 475)

Photos, Hugh Farmar

Fig. 244—The White Bougainvillaea in Zanzibar (See p. 486)

Fig. 245—*Eriobotrya japonica*. The Loquat in fruit at Maidwell Hall, Northants.
(See p. 488)

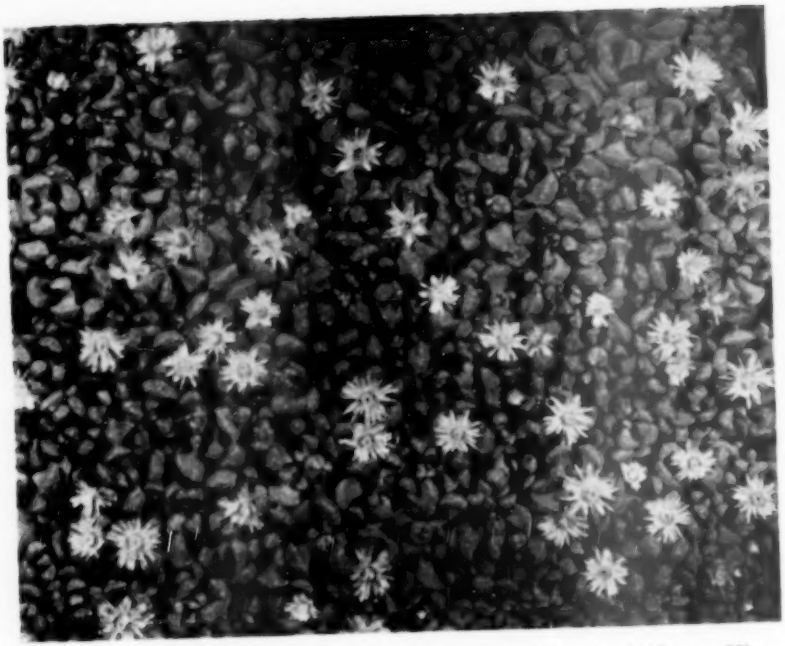


Fig. 246—*Rhinephyllum Broomii* L. Bol. Year old seedlings, × ½ (See p. 488)

Photos, L. S. Clarke

Fig. 247—*Rhinephyllum Broomii* L. Bol. Close-up of year-old seedling showing expanded capsule with seeds open to view. × 3 (See p. 488) Inset: Seeds germinating direct from capsule. × 3

Fig. 248—*Arenaria tetraquetra* var. *frigida*, Sierra Nevada: Peñones de San Francisco
(See p. 449)

Photos, P. H. Davis

PLANT COLLECTING IN THE MOUNTAINS OF ANDALUCIA

Fig. 249—*Convolvulus nitidus*, Pico de Cabañas, Sierra del Pozo Alcon (See p. 478)

Photo, V. H. Heywood

Fig. 250—*Verbascum Hervieri*, Barranco de Guadelentin, Montes de Cazorla (See p. 448)

Photo, P. H. Davis

PLANT COLLECTING IN THE MOUNTAINS OF ANDALUCIA

Fig. 251—*Viola cazorlensis*, Cerro Cabanas, Montes de Cazorla (See p. 449)

ANGUILARA had travelled extensively in the East and devoted himself to enriching the garden with new plants. Not only their cultivation, but also the collection of funds to finance plant-hunting expeditions are frequently mentioned in the early records of the Garden. These expeditions were probably the first of their kind.

ANGUILARA was succeeded by MELCHIRRE GUILANDINO, an equally zealous director (d. 1589), who was the first person to botanise in the field. The next director, PROSPERO ALPINO, was the author of *De plantis Ægypti* and *De plantis exoticis*, which were among the first books dealing with foreign plants, the fruit of his journeys in the Near East. He also, while still primarily interested in medicine, introduced coffee into Italy.

It would be a fascinating, but difficult, study to trace the plants first brought into Europe through the Paduan Garden; but a few are known with some certainty. Of these Oriental Hyacinths, which after years of hybridization became the familiar Hyacinths of our gardens, pots and bowls, are known to have been so introduced. In all probability various species of Tulips were similarly imported, though in the case of both plants the honour of introducing them generally to gardens, and incidentally of starting the extraordinary Tulip mania which swept the Low Countries in the seventeenth century, went to the Dutch successors of Venice's mercantile greatness. The American Agave was growing at Padua in 1561 and the Potato, which reached Italy from England, in 1590. The garden still contains the original oriental Plane brought into Europe, a flourishing veteran which indirectly is probably the ancestor of all the "London" Planes. Other notable trees are the first *Magnolia grandiflora*, and the original *Ginkgo biloba*. All these old trees bear the date of their planting.* It seems clear that long before the Garden officially ceased to be a physic garden, it had become in practice one of great botanical and horticultural interest.

The formal conversion from a medical to a botanical garden in accordance with the new concepts of LINNAEUS took place in the eighteenth century under the guidance of GUILIO PONTEDERA (1719–1757); but the original lay-out was found equally suitable to the growing of botanical specimens as for the herbs used in medicine. Perhaps fortunately, a project of the Venetian Senate in 1591 to embellish the Garden with fountains and statues had come to nothing and prevented a possible decline into a flowerless pleasure-ground of which there are so many in Italy.

Among the Garden's later directors may be mentioned VISIANI, who made a notable collection of classical authors and published the first work of the flora of the Dalmatian coast, and the distinguished mycologist SACCARDO, who held the Chair until 1915 and built the research laboratories. The Garden is still a centre of research work and thus has an uninterrupted record of service for over four centuries.

To the layman the Paduan garden is a place of singular beauty and charm, apparently preserving, in its most unusual form, the exact shape

* Near by, in the cathedral cloister, is an equally famous Magnolia, a tree of such enormous proportions that even the dimensions of the very large cloister fail to dwarf them. When in flower and covered with hundreds of its huge ivory cups it is a magnificent sight. It is probably the largest tree of its kind in Europe.

in which it was laid out in 1545. It is true that the encircling wall and the gates were not completed until the first years of the eighteenth century, but the authorities were wise in constructing a small arboretum outside the Garden proper and in not attempting to grow too many trees in the Garden itself. The same applies to the few glass houses, one of which was built to protect a Palm much admired by GOETHE. This rather ugly structure does not mar the beauty of the almost miraculously preserved garden, while it did not serve to prevent the Palm being killed to the ground in the great frost of 1947–48. Now, however, the tree is throwing up several new heads from the base. (Fig. 242.)

Circular gardens are very rare, and none contemporary with the Paduan garden now exists; although a sixteenth-century print of DUPÉRAC'S shows another circular garden, built inside the so-called Mausoleum of Augustus, within which is a series of concentric flower-beds bordered with Lavender or Box. The entrance is a rusticated porch surmounted by a gigantic head. Creepers and Espaliers grow on the walls.

This garden has long ceased to exist; but it may have been inspired by the garden at Padua.

Walking through the Paduan garden past the innumerable little flower-beds, each with its particular plants, one is continually reminded of the great English herbals. It is a surprising thought to realize that this Garden was already matured when those comparatively ancient books first left their printers. With its mellow beauty, its fountains and shade, grateful after the torrid pavements of the city, the continual surprises which it holds for the visitor in the shape of new plants and the intriguing patterns of its flower-beds, it is indeed a place of enchantment.

I am greatly indebted to SIGNOR GIUSEPPE GOLA for leave to quote from his history of the Orto Botanico written to celebrate the fourth centenary of its foundation.

PLANT COLLECTING IN THE MOUNTAINS OF ANDALUCIA

Vernon H. Heywood, B.Sc.

PART II

THE classical areas in Sierra Nevada for plant collectors are the schistose screes and alpine meadows in the region of the three great peaks—the Veleta, Mulchacén and Caballo—and the outcrop of limestone called the Cerro Dornajo whose slopes provide many of Spain's fine plants such as *Convolvulus nitidus*. (Fig. 249.) These we visited again with encouraging success adding scores of plants not seen in 1947. Two of the notabilia were *Chaenorrhinum glareosum*, an exceedingly attractive alpine which has flowered well at Wisley, and *Linaria glacialis*, a curious annual with fleshy whorls of glaucous leaves from which rise overlarge mauve corollas.

There is one area which has been singularly neglected—the Cerro Trevenque whose white dome can be seen from many parts of the Sierra projecting in the seemingly inaccessible distance. The intrepid Swiss botanist, BOISSIER, visited it, as did many other collectors during the golden age of Spanish botany—WILLKOMM, DEL CAMPO, BOURGEAU, and FUNK—but in recent times the Trevenque appears to have been overlooked. It was for us an unknown quantity—rumour had it to be a barren pile covered with *Erinacea Anthyllis*—yet by blind faith we were certain that *Scabiosa pulsatilloides* would grow on it (one of the results of hurried preparations, else we should have known that it did); and it was limestone.

On our last night in the Veleta area we did some rapid bargaining with the shepherds who brought goats' milk to the Albergue Universitaria where we were staying, and secured two mules for an improbable hour the next morning. Although we were over an hour late in starting it was still dark when we left and bitterly cold. Stumbling blindly into the valley of the Rio Genil we could collect only plants such as *Verbasca* which were sufficiently large to be obvious. The climb up the other side of the barranco was dangerous for the beasts; the loose sand of the track frequently subsided and the mules laden with our accumulated collections had to be dragged forcibly to safety.

Soon the sun was high above us and the red sand merged into the grey and white of limestone; and beyond a crest we saw our goal, the Cerro Trevenque, a gleaming white cone rising cleanly above the surrounding plains. The approaches were of sun-scorched shrub—*Erinacea Anthyllis*, *Ptilotrichum spinosum* and its rarer relative *Vella spinosa*, Genistas, Thymes and Honeysuckle, and the giant fruiting spikes of Asphodel each with its cluster of spherical capsules.

A halt was made for lunch at the base of the mountain in a small forest of *Pinus sylvestris* var. *nevadensis* which partly covers the eastern slopes. The Pine is stocky and resembles little the northern-European plant in habit; most authorities accept it as truly native thus making the Cerro Trevenque its meridional limit. Evidently it reached this area in its retreat south during the Pleistocene Glaciation.

The nearer one approaches the Trevenque the more remarkable it appears: ridge after ridge of white and grey limestone and marble, churned into pebbles and even powder, sweep down to the surroundings where slight eminences of the same shades cut off little valleys, so that, cindery under foot, it seems like walking through a lime-kiln ! It is difficult to conceive of a more xerophytic habitat; but flowering here was Spain's most elegant species of *Echium—E. albicans*, a foot or so high and entirely clothed in dense white tomentum spiked by long pellucid-tipped hairs. The young stalked flowers are red when they open and mature a violet-purple.

Leaving our guides with the recalcitrant mules we climbed the eastern ridge to its steep north face; loose chalk and marble overlying firm chalk formed a perilous substrate and the last few yards had to be scrambled over on all fours. A rich reward was found in three superb *Anthyllis*—silver-leaved and saxatile—*A. Tejedensis* with golden globes of Pea-flowers, another related yellow-headed species, and a third

crimson-flowered with leaves like silver spoons. There was seed on all. *Thymus granatensis* var. *longiflorus* was abundant, as was *Convolvulus nitidus*, and at last the object of our climb—*Scabiosa pulsatilloides*. This dwarf scabious rivals *Pterocephalus spathulatus* in exclusiveness and beauty; it grows to a few inches above the white scree and sends out broad violet-blue heads on short stalks from within its divided silver leaves. The excellent plate in BOISSIER's *Voyage*• though remarkably fine does it scant justice. Later in the year I collected sufficient seed to establish *Scabiosa pulsatilloides* in cultivation in this country. Our exaltation was completed by finding, scattered on the slopes *Helianthemum pannosum*, another endemic of note. The small caespitose bushlets were densely formed with shortly petiolate leaves clothed in snow-white felt; most of the croceous flowers had dropped off and the succeeding capsules held ripe seed.

The analogies offered by the flora of the limestone areas of the Sierra Nevada are most interesting, especially by this calcareous outcrop of the Cerro Trevenque, just described, above the *Pinus sylvestris* var. *nevadensis* zone. The habitat is ecologically very similar to that outlined in the Sierra de Cazorla (Prado Redondo), and the parallelism of species is striking. *Pterocephalus spathulatus* is not represented here, but *Convolvulus nitidus* grows with the equally beautiful and much rarer Scabiosad—*Scabiosa pulsatilloides*, endemic to the Cerro Trevenque; its associates include *Arenaria armerina* var. *elongata*, *Teucrium flavum*, a *Centaurea* (apparently the same as the Cazorlan form), and *Helianthemum pannosum*.

Certainly a return visit to this isolated haven of fine plants would be rewarding.

Eastwards to Ronda where our arrival at the railway station caused the porter a problem. Ronda was remarkable for one thing at least—on our first morning there we changed our lodging from a pension to an hotel, and left for Grazalema in the afternoon where we descended the scale by sleeping in the *fonda*!

Grazalema—a white village of flat-roofed houses and steep cobbled streets climbing up the mountainside—lies a few miles within the bounds of the province of Cadiz, adjoining Malaga. Our arrival coincided with preparation for the village's Saint's Day, resulting in a marked reluctance of the *fonda* keeper to give us room; and naturally there was considerable difficulty in finding guides. When our comparative wealth became apparent the situation became eased and we left for the mountains in the morning with two young shepherds who, if not excessively obtuse, certainly appeared so! It soon became apparent that it was useless asking them for information for they remained solidly asinine, and as a result any success in finding desired localities was due to the kindness of the Fates.

Grazalema meant two things to us—*Centaurea Clementei* and *Abies Pinsapo*. As the locality for the former could not be traced the only course open was to cover as much likely-looking ground in the time available. On a limestone ridge, the Peñon Grande, above the village, we soon came across the delicate annual *Campanula speculariodes*, its

• Voyage Botanique dans le Midi de l'Espagne.

deeply five-cleft violet-blue corollas already withered above its globose capsules. *Saxifraga gemmulosa* was dried up almost beyond recognition. On the dry rocks grew an attractive *Rumex*, a glaucous saxatile shrub covered in showy pale pink-white fruits: it should make a useful "foliage plant." Another inhabitant of these rocks was a prostrate and brittle *Chaenorrhinum* with pale-lilac flowers and darker veining; it had all the appearance of *Campanula mollis* and only a closer examination revealed its identity. The *Campanula* grew here also, but no seed of it could be found; indeed *C. mollis* frequently fails to produce viable seed whether in nature or in cultivation.

Two *Phlomis* were collected during the day—*P. crinita* with bicoloured "toffee" hoods and a concolorous form; and the shrubbier *P. purpurea*. Other notabilia included *Biarum arundanum* with both spathe and spadix a shade of maroon; it is apparently endemic to the Ronda-Grazalema region.

Mid day came, and there was no trace of *Centaurea Clementei*; we separated each with a guide: PETER DAVIS to the rocks beyond the Peñon Grande and myself to the Sierra del Pinar, the site of *Abies Pinsapo*. There was no difficulty in finding the Pinsapo for it forms immense dark green masses on the north slopes of the Sierra (1,654 m.). The dense shade afforded by the strong branching of these gigantic trees excludes to a large extent the development of undergrowth: a thick mat of dead leaves and old fruits and seeds covers the floor of the forests. At the present time *A. Pinsapo* survives in an extremely contracted area—on Jurassic limestone in a few mountains in the south, and in Morocco near Xauen. It would seem that the Pinsapo is destined to virtual elimination: Spanish foresters tell the sorry tale of human and animal interference and point to the disappearance of other Mediterranean *Abies* within historic time, such as *A. nebrodensis* from the slopes of Etna in Sicily.

And the Centaurea? After a brave search PETER DAVIS came across it on the continuation of the Peñon Grande, 3 or 4 miles south-west of Grazalema. There it sat on treelike stumps of rootstocks emerging from the rock fissures, perennating year after year; its thick woolly-white leaves like paddles and its stems over a foot tall. The vast capitula had shed their yellow flowers, the fruits being surrounded by silvery scales with large shiny brown appendages. A relict and a giant. It is possible that BOISSIER saw these selfsame plants a century ago: a sobering thought indeed.

The evening saw the celebrations of the Saint's Day in full course. Everyone of the villagers turned out for the procession of the Virgin, the Image preceded by tiny acolytes staggering under the weight of heavy crosses three times their height, and accompanied by the Guardias Civiles looking rather self conscious in their ceremonial green uniforms with canary-yellow belts. Then the singing and dancing long into the night.

Leaving the village next morning, we saw from the bus great clumps of *Centaurea Clementei* looking down majestically from overhanging rocks above the road!

The old and new towns of Ronda face each other across the dramatic

chasm of the Tajo. A path leads down to the river flowing through the bottom of the gorge, and on the conglomeratic cliffs grew *Moricandia Ramburii*, a curious Cruciferous shrub; it is many-stemmed from the base, the leaves thick and glaucous and the flowers purple. We managed to break off a few branches and collected some seed from the long narrow siliquae. Growing in the tufa rocks was the perennial *Linaria melanantha*, a species variable in the colouring of its corolla; the delicate glaucescent plants here retained a few flowers of pale lilac with darker striations, shading to buff on the spur. The lip of the corolla was dark maroon-purple.

Other Tajo plants were *Trachelium coeruleum*, *Campanula mollis* var. (without seed) and a perennial *Chaenorrhinum* with pale violet flowers. Most of the summer flora was dried up, the season being particularly hot and arid.

Motivated by thoughts of finding the pink-flowered *Leucanthemum arundanum*, we left for Yunquera. The journey, by bus, was a dreadful experience: each minute we seemed doomed to destruction by swerving over a precipice or by colliding head on with a lorry on a steep and narrow mountain road. The least concerned person was the driver who sat nonchalantly, one hand at the wheel and a cigarette drooping from his mouth.

Our plan was to hire mules and make our way back to Ronda through the Sierra de Tolox and the Serrania de Ronda. As this meant a double journey for the mules, and thereby cost twice the price, we left with some misgivings. Not far above Yunquera we rode into a *Cistus-Quercus ilex* scrub: species of *Cistus* and *Halimium* formed a constant cover for some miles with large bushes of *Bupleurum spinosum* as one of the dominants. *Coridothymus* (*Thymus*) *capitatus* was present with a white form frequent among the typical lavender-blue-flowered plants; and the dark purple spikes of *Lavandula lanata* showed up here and there in the grey and green herbage.

After a few miles we came to a zone of *Abies Pinsapo* with *Daphne gnidium* and *Crataegus* draped with mistletoe (*Viscum cruciatum*?). Above the *Abies* were sparse forests of heavily galled *Quercus*, and we started to climb Torrecilla, peak of the Sierra de Tolox. The vegetation was barely interesting floristically—enormous mats of *Juniperus sabina* var. *humilis*, horrid clumps of *Erinacea*, and a touch of colour in *Lactuca viminea*, its pale yellow ligules coppery on the reverse. Evening came and we seemed to have collected not a single plant of note: Torrecilla appeared barren, the scrub and forests below were monotonous. Perhaps we were tired, for Yunquera and its surrounding mountains are noted for the richness of their flora. It seems we had missed not only *Leucanthemum arundanum*, but also *Digitalis laciniata*, *Ononis speciosa* and several others. We reached Ronda by evening, whereupon one of our mules collapsed in a shower of sparks on the cobbled streets throwing our baggage to the ground!

Following a brief interval in Sevilla, we changed our centre to the coastlands and salt flats of Murcia on the south-east seaboard. By now it was late in July and conditions were becoming rather difficult. Théophile Gautier expressed the opinion that one ought to visit

foreign countries in their violent season: from a horticultural point of view this has its advantages when the country is Spain and the region Murcia, for in July nearly all plants have seeded; but the actual plants are mainly shrivelled and useless for botanical collection.

The town of Murcia is dusty above all things else—thick swirling white dust covers everything at the slightest breath of air. It is as though the very buildings are crumbling to powder. Architecturally it has little of distinction apart from the magnificent Baroque façade of its cathedral; botanically and horticulturally it has nothing to offer. The surrounding countryside is steppe, occasionally desert-like, African and barren; great umber mountain ranges break the monotonous skyline.

We took a bus from Murcia through this desolate country towards the coast, halting for a night in the mosquito-ridden port of Torrevieja. Another bus carried us to San Miguel de Salinas, a small village at the edge of the salt marshes. We enquired at the local bar about a thyme which we were looking for—in Spain the country people still show a considerable knowledge of herbs and their medicinal uses. It was not altogether surprising then to be shown a tin full of the Thyme and told that it was used to make a tea-like infusion by putting it through the chromium-plated "express" coffee machine!

Immediately outside the village on the chalky hills along the edge of the Torrevieja road, the Thyme, locally known as *cantueso*, grew in some abundance. The species is a pink-flowered member of the *Pseudothymbra* section and in many respects intermediate between *T. longiflorus* and *T. Funkii*. It has not been previously described but I think it can be accommodated in *T. moroderi* Martinez, based on *T. longiflorus* var. *ciliatus* described by SANDWITH from the Valencian coast. The San Miguel form is not so attractive as the Valencian plant which has sizeable bracts of a dark purple colour, and margined with ciliate white hairs; but we found some good variations here, both as regards flowers and bracts, which should be well worth growing. Little seed was set: the spikes were heavily infested with insects, but up to 90 per cent. germination has been obtained from what seed we did collect.

There were many halophytes amongst the accompanying plants—the fragrant white-flowered *Ptilotrichum maritimum* and orange-headed *Odontospermum maritimum* to mention only two. An interesting find was what purported to be a diminutive form of *Viola arborescens*. Further seawards, on the Salinas de Torrevieja, we collected an unusual *Teucrium* with thick heads of pale lemon-yellow flowers, and several species of *Limonium*—the first of very many.

In the evening we returned to Murcia, only to leave again the next morning, in a large yellow bus, for the naval base of Cartagena where, above the harbour, there grows the magnificent Sea Lavender *Limonium insigne*. In Cartagena the only means of transport available at a reasonable price was a very small taxi. And in this we rode precariously above the harbour to the place known as La Terrosa. Unwittingly we were driving into a protected military zone. Before long we were challenged, but our letters and papers of identity seemed to satisfy the

guards as to our harmlessness, for they allowed us to proceed. Scrambling down the rocks of La Terrosa above the bay, Algameca Grande, it soon became obvious that all was not well: above us soldiers were blasting the cliffs with explosives and great lumps of stone showered down on us! Before our ungraceful retreat we found about ten plants of *L. insigne*; only one was in flower, the rest apparently fruiting, although rarely with seed.

The second locality for the *Limonium* was the eminence above us. Before long another group of guards halted us and this time we were forced to turn back. But the taxi, small as it was, could not turn; nor indeed could it go forward for the engine had stopped. Then followed the harassing experience of freewheeling backwards down the narrow winding road to start up the engine; and as this was not successful we had to continue in this precarious manner all the way down. The brakes, I might add, were very imperfect.

If the above episode sounds like a comic-opera-way of collecting plants, the events that followed during the tracking down of *L. caesium* must be classified as farce. All the information we had about this plant can be summed up as "near Elche."

Elche is easily reached from Murcia by a road which meanders through a Moroccan countryside of undulating sand, and if the palm-shaded landscape suggests North Africa the blue domes and the minarets amidst the flat-roofed white-washed houses confirm the impression.

Our plan in Elche was to produce a specimen of the *L. insigne* from Cartagena and enquire where a similar plant was to be found nearby. The Spanish love this sort of thing; they will stop the normal routine of life and conspire amongst themselves to arrange what seems to the uninitiated a gigantic hoax. The ritual unfolded as follows: one man said that he knew where the plant grew and would return later to show us; another said that it grew by the roadside at the edge of the town. We hired a taxi to investigate. We found blue *Limonium*, white *Limonium*, tall and short, fat and thin *Limonium*, but no *L. caesium*. A third man took us to his house and did in fact produce the desired plant —from a vase where it was being used, very successfully, as an Everlasting. He did not know where it grew. As the first man did not reappear we were forced to seek him out (in a taxi—the same driver—he had become interested); not unexpectedly he produced for our examination a common blue *Limonium*, and insisted, ably supported by the taxi driver, that it was what we were looking for. We were only botanists, we could not argue.

The time grew late; the absurdity increased. Every species of *Limonium* that grows in Spain seemed to have appeared in Elche, and we made expensive taxi journeys to see them! The end was reached after a long day of conference, intrigue and bribery—often beyond our comprehension. The characters involved included a rapacious farmer, a minor government official and a garage proprietor.

A few miles from Elche on the salty flats of El Salador, near the Palm oases, *L. caesium* grows in wide acres. We were led there by a young man who had collected the plants for the last ten years to spread on the streets of Elche during the festivals of Corpus Christi.

The *Limonium* had long since seeded, covering the sand with a deep layer of fruits; almost unlimited quantities of seed could be scooped up there like wheat from a granary floor.

L. insigne and *L. caesium* are amongst the most beautiful and showy of plants. I cannot refrain from quoting WILLKOMM again: of the former he says, "Planta eximia, generis species elegantissima ac pulcherrima!", while the latter is "Species pariter perpulchra." *L. insigne* is the larger-flowered of the two—the tube of the corollas reaching the magnificent proportion of 4 lines diameter—but its panicles of two-flowered spikelets are smaller and less floribund. And in turn, although the flowers of *L. caesium* are almost half as small as in the other, its profusion of pink one-flowered spikelets forming great pyramidal panicles makes it such a spectacular sight when in full flower that, for me, it is the finer plant.

After Elche we continued our tour of the Spanish Levante and returned through the steppes of Albacete to Madrid.

Many plants and happenings of our journey must be omitted here, such as the intriguing *Teucrium pumilum* found near Alcoy with its procumbent stems appressed to the rocks; *Digitalis mariana* in its *locus classicus*, the rocky hills at the gorge of Despeñaperros in Ciudad Real, looking for all the world like a Mullein; the distant enticing sierras which there was never time to explore; the nightmare journey on the footplate of a railway engine; the sight of our drying paper blown from the roof of our hotel in Madrid being wafted down to the Puerta del Sol. . . .

It would take many, many months to exhaust the wealth of the Spanish flora; we attempted to skim off the cream; but what we left is indeed rich.

THE WHITE BOUGAINVILLAEA

R. O. Williams, O.B.E.

FOR many years the White Bougainvillaea was no more than a myth but it was not uncommon to meet or be told of people who were convinced that they had seen one.

In 1919 I searched an old monograph of the genus Bougainvillaea at Kew but could find no mention of a white species, although I did find reference to some with such uncommon colours as greenish and pale yellowish but, so far as I remember, the bracts were small and inconspicuous. In 1922 I placed on record my subsequent enquiries in the Bulletin of the Department of Agriculture, Trinidad and Tobago, pp. 121–122, which were briefly as follows:—

A lady from Rangoon volunteered the information that a white Bougainvillaea was in cultivation in Burma, but the reply to enquiries was that none of the Botanists, Agriculturists or Forestry Research staff had heard of, or seen the plant in Burma. Someone suggested to try Mauritius but on making enquiries of the Director of Agriculture there

he replied "The white Bougainvillaea does not occur in Mauritius." He continued by saying that he had made enquiries from a number of horticultural amateurs, one of whom stated that he recollected having seen mention of the white Bougainvillaea being in the forests of Trinidad! The writer is very familiar with these forests and *no* Bougainvillaea, let alone a white one, occurs in them.

In reply to an enquiry of the Superintendent of Botanical Gardens Cuba he said "We have no white Bougainvillaea, our small plant having died."

There the matter rested, so far as I was concerned, until some time in the early 30's when the late MR. H. A. BALLOU drew my attention to a few pure white bracts on a large inflorescence of the Ecuador pink Bougainvillaea ('Lady Hudson') in Trinidad; there was no recurrence of this and the white portion was not propagated. It was not until 1939 that the White Bougainvillaea was actually introduced from Brazil to Trinidad by DR. S. C. HARLAND, through the courtesy of DR. K. BARTLETT of Porto Rico. I was not there at that time and I have no particulars as to its origin, whether it was a horticultural sport or seedling or had been found in a wild state.

The original plant grew well in Trinidad and was quickly propagated; a few years later I had a magnificent specimen at my residence growing down over a 12–15 feet wall and the admiration of everyone.

The plant is typically of scrambling, semi-climbing habit but it grows well in bush form. The flowers are borne all along the upper parts of the branches or in more or less compact sprays at the tips. In detail the bracts are pure white with greenish centres, the true flowers having a green tube, with a green and yellow corolla when expanded. In a group of plants such as the Bougainvillaeas noted for their brilliancy of colour it is difficult to particularize, but it may be said that the white ranks with the best of them. The leaves are oval and tapering at both ends and entirely without hairs.

In due course I sent a plant from Trinidad to an old acquaintance MR. W. G. KAYE of Guildford. In 1947 I saw a small spray of bracts exhibited by him at a Royal Horticultural Society's show in Vincent Square. Kaye had passed on a plant to Kew and in November, 1948, at the request of the British Resident, Zanzibar, SIR VINCENT GLENDAY, K.C.M.G., O.B.E., I brought by air to Zanzibar the white Bougainvillaea, and so far as I know this was its first introduction to East Africa. It was planted in the gardens of the Residency and has since made wonderful progress; the illustration (Fig. 244) was taken about 18 months after planting out. Subsequently plants were taken from this to Kenya and one, at least, has become established at the Municipal Park, Nairobi, and another in front of the offices of the Provincial Commissioner at Kisumu.

The plant is comparatively easy to propagate from the slender tips, in sand or soil. Tropical Agriculture Vol. XXVI, p. 4, suggests a method whereby 100 per cent. success was obtained by dipping the cuttings in paraffin wax and treating with hormone powder. I have rooted them myself by merely placing small cuttings in the soil at the root of the parent plant.

NOTES FROM FELLOWS

Cuttings of Deciduous Conifers

MAJOR PAM and other Fellows may be interested to know that another deciduous tree, very closely allied to the conifers, *Gingko biloba*, will root from dormant wood.

A neighbouring tree having fallen into the hands of a speculative builder I took a few cuttings from it on March 6, 1939, and, the war having upset his plans, another lot on January 9, 1944. Some were put in out of doors and others in a box of sand and peat in a cold frame in a shady place. Those out of doors died, but on each occasion those in the frame produced a small number of plants sufficiently well rooted to pot up in August.

The 1939 lot were eventually inadvertently trodden on and destroyed. Those rooted in 1944, produced nothing but rosettes of leaves —bigger and better each year—with no more than the consequential "spur" growth until this spring when they started to grow vigorously and have now much more than doubled their length.

My experiments were made in a haphazard way and with a handful of cuttings only and I have no doubt that an experienced propagator with heat and proper equipment could root cuttings of dormant wood easily.

MILES HADFIELD

Rhinephyllum Broomii L. Bolus

A choice stemless Mesembryanthemum

Of sixty-five batches of Mesembryanthemum seed MR. H. HERRE, of Stellenbosch, generously sent the John Innes Horticultural Institution for germination tests in 1949, no species proved a more welcome surprise than this. Its habit recalls that of *Titanopsis*, large white pustules covering the almost globular leaf tips, which are further adorned by small projecting horny teeth. Unlike the notoriously delicate *Titanopsis*, however, *Rhinephyllum Broomii* is vigorous and quick-growing, speedily forming lateral shoots and a tuft of several heads. The calendar of its progress in 1949 was:—

DATE	DAYS AFTER SOWING	
April 26.	0	100 selected seeds sown (by standardized procedure) in J.I. Seed Compost.
May 9.	13	3 seeds germinated. (Unhappily these damped off.)
May 21.	25	3 more seeds up. No further damping off noted. Others germinated at intervals up to
June 3.	38	36 up. Rapid growth beyond cotyledon stage.
August 5.	101	38 now up. Lovely, grey incrusted rosettes, uniformly 2–2·5 cm. across and averaging 4 pairs of leaves each.
Aug. 15.	111	Pricked out into rectangular trough of J.I. Potting Compost 1.
August 29.	125	First 2 flowers opened. Others followed in increasing numbers, but exact records were not kept.

The final germination figure was rather low: 41 per cent. The most striking inference from the above figures is that, discounting the three seedlings which damped off, the first flowers opened just *100 days after the seed germinated*. I must confess that, without my own record book before me, I should not have believed anyone claiming to bloom stemless *Mesembryanthema* in 3½ months! (Incidentally, the annual species are even quicker to mature, four forms of *Dorotheanthus* expanding their first buds within 2 months of germinating.)

Nor is early flowering the only virtue of *Rhinephyllum Broomii*. I wish now I had recorded the total flower output for each plant: the number produced must be astonishing. The yellow blooms, though small (they average 1·5 cms. diam.), seem to come in succession without a break for the whole summer. They expand for a rather short daily period from 5.0 P.M. to dusk, when the effect of constellations of gold from a large pan, as that in the photograph (Fig. 246), is for ever pleasing.

Shortly after this photograph was taken, it was noticed that seed had set and was germinating freely round the parent plants, both in the soil and from fallen capsules, and even from capsules still attached to the plant. Fig. 247 (inset) shows whole fruits sprouting seedlings, some of which make their entry into the world via the capsule walls.

Rhinephyllum first met the eye of gardeners as a new genus in July 1927, when N. E. BROWN defined it, basing it on two recently discovered plants, in the *Gardeners Chronicle*. MRS. BOLUS described *R. Broomii* in her "Notes on Mesembryanthemum," III, 14, nine years later, and followed it by a review of the genus on pp. 40–43, where eight species are keyed: at least two more have been added since then.

Fig. 247 shows the open cells of the fruit which serve to distinguish the genus from the closely allied *Stomatium*.

On the strength of its dainty habit, vigour, and profuse flower production, *R. Broomii* should prove an ideal plant for beginners in Ficoidaceae. I hope dealers will be quick to multiply it now seed is available.

I should add that my own was received under the unpublished name 'Rhinephyllum ?Borreri L. Bol.'—doubtless a result of label misinterpretation.

GORDON ROWLEY

Eriobotrya japonica

In 1948 and again in 1950 a bush of *Eriobotrya japonica* fruited in this Northamptonshire garden. Each of the previous years was unusually hot so that the wood was well ripened. The flowers, which so much resemble a Hawthorn both in appearance and scent, were fully out in December and January, and the orange fruits were ripe by the end of August. These are edible, though not particularly luscious, and contain one to five large seeds which have the appearance of miniature horse chestnuts. They germinate freely even in the open ground. (Fig. 245.)

The bush is some 12 feet high and as much across, and is planted in a south-east corner with wall protection. In this situation it has never suffered the smallest injury from frost or cold winds even in the most severe winters. It will be noticed from the photograph that the

leaves of this particular specimen are much narrower and smaller than those usually seen and this supports the contention that those forms of evergreen shrubs with narrower leaves are usually more hardy than those whose leaves are broader.

The Loquat was introduced into this country in 1787, but it does not seem to be grown extensively except in the south-west; perhaps the propagation of hardier forms would lead to a wider distribution.

OLIVER E. P. WYATT

PLANTS TO WHICH AWARDS HAVE BEEN MADE IN 1950

Buddleia Davidi 'Royal Red' A.M. August 1, 1950. An attractive seedling with dense panicles of Imperial Purple (H.C.C. 33) flowers with orange throat and eye and slightly frilled corolla. The colour of the flowers contrasts well with the dark green of the oblanceolate leaves, which are greyish-white beneath. Exhibited by Messrs. R. C. Notcutt, Ltd., Woodbridge, Suffolk.

Cotoneaster 'Sabrina' A.M. September 26, 1950. A very decorative plant, believed to have arisen from a chance cross between *C. horizontalis* and *C. pannosa*. The gracefully arching and spreading branches reach a height of five feet. The branchlets are evenly clothed with thick, dark green, ovate leaves an inch long, and clusters of from two to six ovoid Capsicum Red (H.C.C. 715) berries about one-half inch long. Exhibited by N. G. Hadden, Esq., Underway, West Porlock, Somerset.

Gaultheria semi-infera A.M. September 26, 1950. A delightful evergreen shrub for woodland or partially shaded rock garden. The arching growths bear ovate-lanceolate, evenly serrate leaves two or three inches long, glossy above and pale beneath. From their axils spring dense racemes of small, egg-shaped berries varying in colour about Princes Blue (H.C.C. 745/1). Exhibited by N. G. Hadden, Esq., Underway, West Porlock, Somerset.

Gaultheria tetramera A.M. September 12, 1950. A very ornamental evergreen shrub two to three feet tall. The finely-toothed lanceolate or elliptic leaves are about two inches long, lustrous green above, paler beneath. The small Sea Blue (H.C.C. 043/1) berries are carried in dense axillary clusters, Exhibited by Messrs. Hillier & Sons, West Hill Nurseries, Winchester.

Hydrangea villosa A.M. August 29, 1950. A striking deciduous shrub discovered by E. H. Wilson in W. Szechwan in 1908. The lanceolate or elliptic, finely denticulate leaves, six to eight inches long, are notable for their deep and rich colour which matches the Spinach Green of the Colour Chart (0960). The flower-heads are terminal on young shoots, about six inches across, and comprise a central mass of small fertile flowers coloured Aster Violet (H.C.C. 38/1) surrounded by a dozen sterile flowers each with four crenate, orbicular petals over half an inch long, varying about Phlox Purple (H.C.C. 632/2). Exhibited by W. Bentley, Esq., Quarry Wood, Burghclere, Newbury.

Rhododendron prunifolium A.M. August 1, 1950. A deciduous species belonging to the Series Azalea, which is especially valuable on account of its late flowering season. The flowers are 1½ inch across, saucer-shaped with a slender tube ½ inch long, borne about nine together in flattish trusses. The colour is Vermilion (H.C.C. 18/1). The leaves are pale green, oblanceolate, cuneate at the base and strigose on the midrib beneath. Exhibited by The Commissioners of Crown Lands, The Great Park, Windsor.

Rosa Moyesii 'Geranium' A.M. August 29, 1950. This compact variety of a popular Chinese species originated at Wisley. The rich orange-scarlet, flask-shaped hips, for which the award is given, are two inches long, and hang from the branchlets in clusters of from three to six. Exhibited by A. T. Johnson, Esq., Bulkeley Mill, Tyn-y-Groes, Conway.

BOOK NOTES

"Orchids their Description and Cultivation." By Charles H. Curtis. Crown 4to. 288 pp. (Putnam & Co. Ltd.) £4 4s.

This is essentially a book for the amateur. All Orchids of horticultural interest are dealt with, and also others that are of special interest. In the first chapter much information is given on the early history and cultivation of Orchids. The author rightly states that the progress made in the importation and cultivation of exotic Orchids is one of the most remarkable developments that horticulture can show. Subsequent pages deal with the distribution of the various species, "What is an Orchid? Variation of Growth, and Mimicry." Amateurs who desire to try their hand at seed-raising will be interested in the chapters on pollination and germination, but no information is given on present-day methods of raising seed on nutrient agar, for the author considers that laboratory methods are expensive and demand the most meticulous attention in every detail; they are only for the big commercial raisers and wealthy amateurs.

Much useful information is given on the structure of an Orchid house, and such matters as temperatures, ventilation, watering and potting materials are fully treated. The main part of the book is taken up with an enumeration of the general species and hybrids. The descriptions are in simple language, and will prove of considerable value to amateurs, not only in Great Britain, but in all parts of the world where Orchids are cultivated. Under the title "Monthly Reminders," details will be found of the principal requirements which are necessary throughout each month of the year. At the end of the volume there is probably the most extensive Orchid bibliography yet published, although one fails to find mention of the several important works which SCHLECHTER wrote on the *Orchids of South America* or of the *American Orchid Society Bulletin*, of which nearly nineteen volumes have been completed.

The book is elegantly produced and the thirty coloured plates are among the finest of their kind that have so far been prepared. In addition there are forty-eight attractive illustrations in monochrome. The author is a well-known authority on Orchids, and the completion of his latest book has been awaited with much interest. Expectations that the work would be of high quality have been amply fulfilled. A copy of the book should be in the library of every Orchid amateur.

GURNEY WILSON

"Orchids and How to Grow Them." By Adelaide C. Willoughby. 135 pp. (Geoffrey Cumberlege. Oxford University Press, London.) £1 1s.

The purpose of this book is to help and encourage the amateur Orchid grower to know and grow these plants, and to show how economically they may be cultivated. Commencing with a chapter on the "Life Secrets of the Orchid", which will be read with interest by all lovers of plant life, there is an extensive account of the Orchid family. Descriptions are given of suitable glass structures, and in the chapter on "Proper Orchid Balance" the differences of growing plants 'soft' or 'hard' are explained. The author states that it is imperative that the plants have water with an acidity reading of approximately 4·5 to 5 *p*H. The important matter of potting is adequately dealt with, and several pages are occupied with the treatment of pests and diseases. The method of germinating Orchid seed on nutrient agar is described, and two reliable formulae are

given. The subject of another chapter is the cultivation of Orchids on gravel with artificial feeding. Finally, there are lists of suitable Orchids for different temperatures, and another on "Prize-winning Hybrids." Sixteen pages of illustrations add much to the usefulness of this book. Although not a Californian by birth, the author has lived there since childhood.

GURNEY WILSON

The Propagation of Alpines. By Lawrence D. Hills. 464 pp. Illus (Faber & Faber.) £1 5s.

This large volume contains not only the lifetime experience of its author in the propagation of alpine plants, but also the fruit of much study and research. It would seem that every method of propagation of alpines is described, and a comprehensive list of plants with the methods appropriate to each is included. Where cuttings are concerned the exact season when the largest number may be expected to root is given, a most important but not often easily obtained piece of information. The use of various root promoting preparations is helpfully discussed.

The author has arranged his vast mass of information on what, superficially, might seem a somewhat limited subject into a system which enables any required item to be found without difficulty. The book appears to be intended primarily for trade growers, but no one interested in plants could fail to derive profit from it.

Numerous photographs and more valuable still, line drawings, illustrate multifarious points on which this remarkable book touches.

MORTON

"Better Hedges." By Roy Hay. 19 pp. and 5 illustrations. (Roy Hay Publications). 1950. 1s. 6d.

This pamphlet describes the planting and maintenance of garden and farm hedges with rather long lists of hedge plants. It begins with a short discussion of hedges followed by notes on planting, after care, the maintenance of neglected hedges and farm hedges, the whole condensed into three pages. Nine pages are then devoted to short descriptions of hedge plants and their suitability for various positions, which are followed by two and a half pages descriptive of hedge cutting with modern labour-saving machinery, the pamphlet being ended by "six major factors leading to better hedges." The six factors are condensed into 73 words. Actually it is a disappointing work, the subject matter being badly balanced; nearly as much space is given to hedge cutting with modern labour-saving machinery as to the whole of the general description of hedges, planting and cultural operations, while for such a small work the selection of hedge plants is excessive.

W. DALLIMORE

"Laboratory Methods of work with plants and soil Nematodes." Technical Bulletin No. 2. By T. Goodey D.Sc., F.R.S. Royal 8vo. Illus. (H.M.S.O.) 9d.

This bulletin deals with the details of the methods which have proved serviceable in the writer's experience and includes methods in frequent use at Rothamsted. It is intended for the laboratory worker and should prove a standard and most valuable work for the investigator of Nematodes.

"Asparagus." Bulletin No. 60. Royal 8vo. Illus. (H.M.S.O.) 1s. 6d.

There seems to be an unsatisfied demand each Spring for good quality Asparagus and consequently intending growers should welcome this practical and authoritative booklet compiled under the auspices of the Vegetable Group of the National Agricultural Advisory Service.

"Flowers to Know and Grow." By Audrey Wynne Hatfield. Demy 8vo. Illus. (Castle Press.) 12s. 6d.

This book contains a number of small tinted drawings of individual flowers together with notes on them. Unfortunately the colouring of the drawings has not been done to coincide with the actual colouring of the flowers. Consequently the effect is somewhat unreal. Much of the material has been published previously in the form of four little books following the seasons. The present arrangement of the book seems to be quite haphazard as is also the capitalization of the specific names.

"Modern Glasshouse Flowers for Profit." By W. E. Shewell-Cooper. Demy 8vo. 207 pp. Illus. (Benn.) 10*s.* 6*d.*

This book is intended as a companion volume to Lt.-Col. Shewell-Cooper's volume on *Modern Flower Growing for Profit* which was published in 1935. The author points out that the demand for flowers still greatly exceeds the supply and that therefore any grower contemplating going in for flower growing should have no difficulty in finding a market for his produce. Nevertheless, conditions have changed much in this respect during the last year, and prospective growers would be well advised to inquire thoroughly as to their markets before embarking on what is undoubtedly a hazardous, albeit in many ways, very pleasant and sometimes also profitable profession. All such growers will be well advised to read also Mr. Secrett's excellent article on "Present-day Problems of the Horticultural Industry" in the May number of this Journal.

This book deals with the construction of suitable glasshouses, soils and composts, pests and diseases, while there are sections on individual genera, suitable for growing commercially.

"The Observer's Book of British Ferns." By W. J. Stokoe. 128 pp. Illus. (Warne.) 5*s.*

This is a new popular work on the British Ferns, and, with the exception of Jackson's *Wayside and Woodland Ferns* and Hyde and Wade's *Welsh Ferns*, it is the only modern work on the subject. The nomenclature has been brought into line with A. B. Jackson, who followed Chritensen's Index and there is a useful introduction and glossary which explains the meaning of the scientific terms employed. There are some curious statements as, for example, the remark that *Isoetes echinospora* is found in Dorset. So it is, but it is a very widespread species found in many other places. On the whole this is a very useful addition to the series of Observer's Books.

A. H. G. ALSTON

"Recent Advances in Fruit Juice Production." (Technical Communication No. 21, 1950.) Edited by Dr. V. L. S. Charley. 176 pp. Illus. (Commonwealth Bureau of Horticulture and Plantations Crops.) 15*s.*

The great technical advances which have been made since the publication of "Fruit Juices and Related Products" in 1939 are adequately described in this greatly enlarged and revised edition. Each of the twelve chapters is written by an expert and the book, which is edited and partly written by Dr. Charley, the recognized authority in this field, will rank as the standard work on the subject in this country.

Almost every aspect of the production of fruit juices, syrups and related products is described, including general developments in processing, canning and bottling of fruit juices and modern methods of concentration and storage. Particular attention is paid to the retention of the original vitamin content of the juices and in this connection the value of de-aeration and pasteurization is emphasized.

The greatly increased use of refrigeration in the processing of fruit juices is a noteworthy feature of the modern methods; this with the lower temperatures which are now employed in the concentration of fruit juices (especially citrus and apple juices), and in the storage of the juices or syrups, has resulted in the manufacture of products of greatly increased freshness of flavour and with increased retention of vitamins. The importance of such advances in technique is very great and the high quality of the products will surely prove a decisive factor in the development of the industries concerned.

In view of the important rôle of pectin in the processing of fruit juices, the chapter on "Pectin-degrading enzymes and their implication in the Fruit Products Industry" is most welcome.

The text is admirably supported by numerous excellent illustrations. This well-planned book contains a wealth of technical information of the modern methods now available and will prove invaluable to the industry and to all those directly interested in the many problems associated with the processing of fruit juices.

S. W. CHALLINOR.

The A.B.C. of the Rock Garden and Pool. By W. E. Shewell-Cooper. 209 pp. Illus. (English University Press, Hodder & Stoughton.) 4*s.* 6*d.*

This little book has evidently been found helpful in the past, for it is, the author tells us, the amalgamation of two books, one on Rock Gardens and another on Garden Pools which sold well before the war.

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Hosta species, ix
tardiflora, ix
Hull, Edwin D., on The Cultivation of Jeffersonia diphylla, 361
Hunkin, J. W. (Bishop of Truro), on Euonymus pendulus, 362
Huntbach, Marion, on "Vegetable and Flower Growing," reviewed, 296
"Huntington Botanical Gardens, The," by William Hertrich, reviewed, 213
Hurst, Dr. C. C., 7
Hurst, Rona, on Notes on the Rosa Species and Hybrids at Wisley, 232
Huxley, Julian on "Soviet Genetics and World Science," reviewed, 370
Hyacinth, susceptibility to Grey Bulb rot, 116
Hyacinthus amethystinus, 328
sp. exhb., lxxix
Hyams, Edward, on "The Grape Vine in England," reviewed, 295
Hydrangea acuminata, 16
var. Bluebird, exhb., xcix
arborescens var. grandiflora, 16
grandiflora, 16
integerrima, 205
intermedia, 16
macrophylla var. Amethyst, exhb, iii
Ami Pasquier, exhb., xcix
Bluewave, exhb., xcix
Hamburg., exhb., iii
Maréchal, exhb., xciii
opuloides, 16
paniculata, 16, 441
var. grandiflora, 301
petiolaris, 316, 437
rosalba, 16
Sargentiana, 16, 238
serrata, 16
var. macrosepala, exhb., xcix
villosa, **A.M.** Aug. 29, 1950...489, cv
Hydrellia nasturtii, lxix
Hymenanthera crassifolia, 329
Hypericum ericoides, 447, 448
dubium, 420
var. Henryi, 15
patulum Forrestii, 15
Hidcote, exhb., c, cii
Rodgersii, 17
Rowallane Hybrid, 17, **27,** 210, 300
undulatum, 420
Hypsella longifolia, 249

Iberis gibraltarica, exhb., lxxxi
semperflorens, 5
subvelutina, 445
Icones Plantarum Omeiensium, xxiii
Rariorum, 23
Ilex Aquifolium, exhb., lxi
var. camelliaefolia, 4
Illicium religiosum, 245
Imperati var. Atkinsii, 64
Incarvillea Delavayi, 153, 221
Indigofera hebepetala, 219
Ingram, Collingwood, 235, 236
Ingram, Collingwood, A simple method of Propagating Camellias, 397
"Insects, Guide to British," by B. D. Moreton, reviewed, 458
"Insects, British, Handbooks for the Identification of," reviewed, 50, 458
Inverewe. A Garden in the North-West Highlands, by Mairi T. Sawyer, 436, **440, 441**
"Introgressive Hybridization," by Edgar Anderson, reviewed, 46
Inula Royleí, 316
Ipheion uniflorum, exhb., lxx
Iris albicans, 434
atrofusca, 363
Bismarckiana, 363
Bridal Pink, exhb., selected for trial, lxxxix
Brilliant Amber, exhb., lxxxix
Bulleyana, 226
Cacique, v
Cascade Splendour, exhb., selected for trial, xc
chamaeiris, 434
Chivalry, exhb., lxxxix
chrysographes, 226
Kermes, exhb., xciv
Cordovan, exhb., lxxxix
Cornhill, exhb., selected for trial, lxxxix
Corporal Mary, exhb., selected for trial, xc
cristata, **A.M.** April 18, 1950, exhb., lxxviii, 414
Danfordiae, 64
Danube Wave, exhb., selected for trial, lxxxix
Delavayi, 226
Desert Song, exhb., lxxxix
foetidissima Pritchard's Superb, exhb., xciii
Forrestii, 226
fulva, v
Golden Russett, exhb., lxxxix
gracilipes, 246
Grant-Duffii, exhb., lxxviii
Great Lakes, 175
Histrio var. aintabensis, 64, **154,** 157
histrioides, 5, 64, **154,** 157
var. sophenensis, exhb., lvi, lviii
Indiana Night, exhb., selected for trial, xc
innominata × Douglasiana, exhb., lxxxix
seedlings Nos. E/185/7, E/32/14, E/185/9, exhb., lxxxix
Jemmy O'Goblin, **A.M.** May 23, 1950, exhb., lxxxix, 418
Joan Lay, 175
Juliet, exhb., selected for trial, lxxxix
Kaempferi, 260, 399, 441
Keene Valley, exhb., selected for trial, xc
Kochii, exhb., lxxxix, 434
lacustris, 399
Lady Louise, exhb., selected for trial, lxxxix
Mohr, exhb., lxxxix
laevigata, 174
Leprechaun, **P.C.** 1950, exhb., lxxxix
longiflora, exhb., lxxix
Lortetii, 363

Iris Magic Carpet, exhb., lxxxix
Mary Vernon, exhb., lxxxix
Melody Lane, exhb., selected for trial, xc
mesopotamica, 434
Mount Timp, exhb., lxxxix
nepalensis, 226
New Horizon, exhb., selected for trial, xc
Nightfall, exhb., lxxxix
ochroleuca, exhb., xcvii
olbiensis, 434
Pale Primrose, **A.M.** 1950, exhb., xciv
Peshawar (I. iberica × I. macrantha) × I. chamaeiris, exhb., lxxxii
Pinnacle, exhb., selected for trial, xc
Rare Marble, exhb., xc
Regelio-cyclus Calchas, exhb., selected for trial, lxxxix
Calisto, exhb., lxxxix
Daedalus, exhb., lxxxix
Teucros, **P.C.**, 1950 exhb., selected for trial, lxxxix, 477
Ulysses, **P.C.**, exhb., selected for trial, lxxxix
reticulata, 55, 64
Cantab, 64
Robin McGregor, exhb., selected for trial, xc
Sarah Goodloe, exhb., selected for trial, xc
Sarah Lee Shields, exhb., selected for trial, lxxxix
savannana, v
Sea Lark, exhb., xc
Seedling, exhb., lxxxix
selected for trial, xc
No. 008, exhb., selected for trial, lxxxix
H.1, 46-2A and 45-25A, exhb., xc
Nos. 55A, 19A, exhb., lxxxix
70/5, exhb., selected for trial, xc
Nos. 301, 702, 801, 812, 826, 908, exhb., lxxxix
No. 925, exhb., selected for trial, lxxxix
805.AA., exhb., xc
Nos. CM 1100, CM 1110, exhb., selected for trial, xc
Nos. W.46/1, W.50/4, X.9/2, exhb., lxxxix
sibirica Tycoon, exhb., xciv
St. Dominic, exhb., selected for trial, xc
St. Osyth, 175
spuria Lilacina, **A.M.** June 13, 1950, xciii, 418
Strathmore, exhb., selected for trial, xc
sub-biflora, 434
susiana, 355
Three Oaks, exhb., selected for trial, xc
Tranquil Dale, **A.M.** May 23, 1950, lxxxix, 418
trojana, 434
Truly Yours, exhb., selected for trial, xc
Twilight Sky, exhb., lxxxix
unguicularis, 59, 358, 424
Ellis's Variety, 59
Iris Wattii, **A.M.**, exhb., lxxiii
Wilsonii, 226
Iris Histrio, var. sintabensis, by F. C. Stern, 157
Iris histrioides, by W. P. Wood
"Iris Society, Bulletin No. 1, of New Zealand," reviewed, 336
Iris susiana by C. H. Grey, 362
Irish Gardens, Some famous, by G. S. Thomas, 236, 236, 237, 315, 317
Ixia paniculata, **A.M.** May 5, 1950, exhb., lxxix, lxxxi, 335
susceptibility to Grey Bulb rot, 116

Janes, Edwin Ridgeway, V.M.H., xxii, 67
Jasione foliosa sub-sp. minuta, 450, 451
perennis, 260
Jasminum Beesianum, 219
nudiflorum, 59
officinale, 219
Parkeri, 320
polyanthum, **F.C.C.**, exhb., xxiii, liv, 67
× Stephanense, 219
Jeffersonia diphylla, 151
Jeffersonia diphylla, The Cultivation of, by Edwin D. Hull, 361
Jelitto, L. and P. Pfitzer, "Dahlien im Garten und im Haus," reviewed, 457
Johnson, A. T., 7
Johnstone, G. H., 360
Johnston, Major Lawrence, 157
Johow, Dr. Frederick, 282
Journal and Botanical Magazine Binding, 2
Julyan, Capt., 328
Juniperus communis var. montana, 197
recurva, 240
Sabina var. humilis, 449, 482
Justice, James, 389

Kalmia angustifolia, 153
latifolia, 78, 154, 220
myrtifolia, 220
Kalmiopsis Leachiana, 153
Kelway, James, 112
Kemp, Mr. 359
King, Capt., 163
Kingdon-Ward, Capt. F., 58, 65, 88, 227, 269
King George V and Queen Mary, silver Jubilee of, 241
Kirengeshoma palmata, 237
Knight, F. P., on Summer and Autumn Flowering Shrubs, 12
Knight, Dr. R. L., on "Dictionary of Genetics," reviewed, 295
Kniphofia brevifolia, 23
caulescens, 23
Galpinii, 340
Gladiator, exhb., selected for trial, cii
grandiflora, 438
Honeycomb, **A.M.**, exhb., ci
longistyla, 24
modesta, 23
Nelsonii, 340

Kniphofia Northiae, 23
rufa, 23
Snowdeni, 24, 26
Uvaria (Kniphofia aloöides), 23, 24, 26
Kniphofia, A Triploid, by E. K. Janaki Ammal, D.Sc., 23
Kolkwitzia amabilis, 240
Kolomikta, 318
Krüssmann, G. and E. Eiselt "Die Freiland-Schmuckstauden, 1: Anzucht und Kultur," reviewed, 457

Laboratory Methods of work with plants and soil Nematodes, by T. Goodey, D.Sc., F.R.S., 1
Laburnocytisus Adami, 174
Lachenalia pendula, exhb., lv
Lactuca viminea, 482
Laelia autumnalis, 269
Laeliocattleya Arcadia (Lc. Jupiter × Lc. Areca), **A.M.** May 23, 1950, exhb., lxxxviii, 416
Eva Robinson var. Easter (Lc. Ishtar × C. Angus), **A.M.** April 4, 1950, exhb., lxxiii, 294
Mullion var. Springtime (C. Atlantic × Lc. Hyperion), **A.M.** March 7, 1950, lxiii, 294
New York var. Atlantic, **A.M.** Feb. 14, 1950, lx, 294
Resolute var. Dauntless, **A.M.** Oct. 18, 1949, exhb., xii
Lantana Camara, 339
Lapageria rosea, 285
Lardizabala biternata, 163, 331
Larix Lyallii, 197
"La Taille des Arbres Fruitiers" by Paul Champagnat, reviewed, 418
Lathraea clandestina, 56
Lathyrus magellanicus, 203
nervosus (Lord Anson's Pea), 203
pubescens, 203
Laurelia aromatica, 355
serrata, 355
Lavandula dentata, 195
lanata, 482
Loddon Pink, exhb., xcix
multifida, 195
Spica, 195
nana atropurpurea, **A.M.**, exhb., xcix
Leconfield, Lady, 185
Ledum palustre, 152
Lees, Edward, 405
Leiophyllum buxifolium, 152
Lemoine, Messrs., 209
Lepidium subulatum, 445
"Les Rosiers dans nos Jardins," by Henry Fuchs, reviewed, 49
Lettuce Great Lakes, exhb., xcvii
Leucadendron arboreum, 423
argenteum, 4
Leucanthemum arundanum, 482
Leucocoryne ixioides var. odorata, The Glory of the Sun, 286
Leucojum autumnale, 300
longifolium, exhb., lxxix
vernum, 55, 149
Leucothoe axillaris, 135
Catesbaei, 154
Davisiae, 154
ixiodes, exhb., lxxxvii
Lewis, Dr. D., 466
Lewisia Heckneri, 440
Libertia formosa, 284, 318, 438
ixioides, 438
Libocedrus chilensis, 162, 239
decurrens, 239, 243
Lilac Lamartine, 173
Macrostachya, 173
Madame Lemoine, 173
Maréchal Foch, 173
Massena, 173
Mirabeau, 173
Souvenir de Louis Spaeth, 173
Vestale, 173
Lilies, The Hybridizing of, An Amateur's Approach, by O. E. P. Wyatt, 378
"Lilies of the World," by H. Drysdale Woodcock and William T. Stearn, reviewed, 367
Lilium amoenum, 367
Ann Constable, **A.M.** July 11, 1950, exhb., xcix
auratum, 440
var. Pauline Tuffery, exhb., xciii
× aurelianense, 378, 383
Bakerianum var. Delavayi, 191, 192
Bolanderi, exhb., xcix
Bridesmaid (L. nevadense × L. Parryi), **A.M.** July 12, 1949...**396**
Brownii, exhb., lxxxvii, 368
× Burbankii, 385
callosum var. luteum, exhb., lxxxvii
canadense, 259
candidum, 367, 383
Fasciated, exhb., c
candidum × testaceum, **P.C.** 1950, exhb., xcii
chalcedonicum, 367, 383
maculatum, 384
Dalhansonii, 379
Davidi, 208, 227, 259
var. Willmottiae, 208, 227, 380
Duchartrei, 227
Farreri, 381
Dunkirk, **A.M.** June 27, 1950, xcvi, **396**, 416
elegans, 368
-Thunbergianum Group, The, 368
Fargesii, 367
formosanum × longiflorum, exhb., lxxxi
fresnense, 379
G. C. Creelman, 260
giganteum, 259, 340, 368, **396**, 438
yunnanense, 237
Green Flush, exhb., selected for trial, xcix
Hansonii, 259, 379
Henryi, 384
hollandicum, 368
Humboldtii, 385
Hybrid 43/52 N.S., exhb., xcvi
× imperiale, 368
Kelloggii, 380
Lady Eve Price, exhb., xcix

Lilium lankongense, 227
longiflorum, exhb., xcii
Mackliniae, **A.M.** May 23, 1950, exhb., lxxxvii, 415
macranthum, 208
maculatum, 368
× Marhan A. 2, exhb., xcvi
J. S. Dijt, exhb., xcvi
Martagon album, 380
Cattaniae, 61, 381
monadelphum, 318
myriophyllum, 368
nevadense, 379, 384, 385
ochraceum, 368
Old Gold, exhb., xcvi
papilliferum, 367
pardalinum, 259, 260, 385, 441
Parkmannii var. Delmonden Ruby, exhb., xcix
Parryi, 379, 381, 384, 385
parvum × Parryi, exhb., xcix, **396**
ponticum, 367
× Pride of Charlotte, 380
primulinum, 368
Princeps, 260, 368, 380
pyrenaicum, 220, 381
Redbird, exhb., xcvi
regale, 191, 226, 227, 260, 351, 381
Ringspot virus, 350, **355**
Roezlii, 379
rubellum, 220
Sargentiae, 260
sempervivoideum, 367
Sheriffiae, 191, 192
Shuksan, 378, 379, 385
× Burbankii, **396**
Stewartianum, 367
sulphureum, 368, 379
Szovitsianum, 220, 259
testaceum, 260, 367, 378, 381, 383, 384
tigrinum, 351, 367
umbellatum, 220, 368
Valiant, exhb., xcvi
Vollmeri, 367
Wallichianum, 367
Wardii, 227, 380
Willmottiae, 380
Lilium Sherriffiae, A New Himalayan Lily, by William T. Stearn, 190, 193
Limonium caesium, 484, 485
divaricatum, 445
insigne, 483, 484, 485
Linaria aeruginea, 452
anticaria, 447
glacialis, 478
melanantha, 482
Lindera Benzoin, 321
Linnaea borealis, 152
Linum chamissonis, 162
syn. L. McRaei, 166
McRaei, 162
usitatissimum, 468
Lippia (Aloysia) Citriodora, 193, 242, 329
Liriodendron chinensis, 321
Liriope Muscari, 340
Lithospermum prostratum, 239, 240
rosmarinifolium, 377, 464
Lithrsea venenosa, 248
Lloyd, Peter, 308
Loasa sp., 162
acanthifolia, 207
prostrata, 207
tricolor, 207
Lobb William, 162, 163, 166, 205, 280, 286
Lobelia cardinalis, 340
fulgens, 340
laxiflora augustifolia (Cavanillesii), 318
polyphylla, 249
Preslii, 339
Tupa, 249, 318
Lomaria antarctica, 318
magellanica, 287
Lomatia ferruginea, 355
obliqua, exhb., lxxxvii, 355, 356
Londonderry, Edith, Marchioness of, 241, 322
Long, H. C., and Winifred E. Brenchley on "Suppression of Weeds by Fertilizers and Chemicals," reviewed, 372
Lonicera americana, 13
etrusca superba, 242
fragrantissima, 5
glaucescens, exhb., xci, xcii
Periclymenum var. serotina, 13
× Purpusii, 5
rupicola, 308
splendida, 219, 448
Standishii, 5
tibetica, exhb., lxxxvii
Tellmanniana,
Luculia gratissima, 377
Ludlow, Sherriff and Elliot, 87, 90, 190, 222, 227, 229
Lunaria rediviva, 164
Lupinus Cruckshanki, 162
microcarpus, 204
Paynei, **A.M.**, 1950, exhb., xciv, xcvi
rivularis, xciv
Luzuriaga radicans, 287
Lychnis chalcedonica plena, exhb., xcix
Viscaria splendens, 220
plena, exhb., lxxxvii
Wardii, 226
Lygus pratensis, 71
Lysichitum americanum, 144, 318
camtschatcense, 144
Lysimachia clethroides, 259
nemorum, 154
Nummularia, 154
aurea, 154
quadrifolia, 259
vulgaris, exhb., civ

Mackaya bella, exhb., lxxxvii
Mackenzie, Osgood, **440**
Macnaughten, Miss, 240
Maddock, James, 389
Marggraf, M. and G. Hartmann, "Das Chrysanthemum, sein Formenreichtum and seine Kultur," reviewed, 457
Magnolia acuminata, 160, 161
borealis, 86
Campbellii, 68, 246, 330, 443
Coco, 161
cordata, 160, 161, 174

Magnolia Dawsoniana, exhb., lxxii, 68, 237, 267, **277**, 321
Delavayi, 246, 319
denudata, 68, 86, 267, **277**
Exmouth variety, 18
globosa, 160
grandiflora, **17**, 242, 321, 330, 477
× highdownensis, **155**, 159, 160
Kobus, 86, 143
Lennei, 330
liliiflora, 86
macrophylla, 143
mollicomata, 68
Lanarth, 68
obovata (hypoleuca), 319, 330
parviflora, 330
pumila (Gwillimia indica) 161
salicifolia, 143, 246, 319, 321
Sargentiana robusta, 68, 267, **276**, **277**
Sect. Cophanthera, 160
Eumagnolia, 160, 161
Gwillimia, 161
Oyama, 160
Sieboldii, 160, 174, 220
sinensis, 160, 159, 237, 318, 330
× Wilsonii, 159, 160
× Soulangiana, lxxix, 86, 330
stellata, 68, 86, 152, 330, 443
subgenus Pleurochasma, 161
× Thompsoniana, 160
tripetala, exhb., xciii, 160
Veitchii, 237, 321
virginiana, 160, 220
Watsonii, 220, 237, 245, 319, 330
Wilsonii, 159, 160, 174
× sinensis, 159
Magnolia, The Highdown, by J. E. Dandy, M.A., F.L.S., 159
Magnoliastrum, 160
Mahonia Aquifolium, 209
Bealei, 60
japonica, 55, 60, 157, 208, 209
lomariifolia, 61, **154**, 157
napaulensis, 55
pinnata, 208, 209
Mahonia lomariifolia, by F. C. Stern, 157
Mainwaring, Miss, 25
Maize with mixed inflorescence, exhb., xxxix, c
Malus baccata, 144
coronaria Charlottae, exhb., lxxxvii
Eleyi, 143
Frettingham Victoria, 144
Golden Hornet, **A.M.** 1949, exhb., xxxvi, 44
Hartwigii, 144
ioensis fl. pl. **F.C.C.**, exhb., lxxxvii, 247
plena, **F.C.C.** May 23, 1950—410
Lemoinei, 143
purpurea, 143
yunnanensis, 321
Zumi, **144**
Malva, 162
moschata, 165
obtusiloba, 165
umbellata, 301, 463
Mandevilla suaveolens, 245, 260, 316, 339
Manglietia insignis, exhb., xcvi
"Manures and Fertilizers and their Horticultural Application," by R. P. Faulkner, reviewed, 49
Marchant, Mr., 360
Margyricarpus setosus, 204
Marle, G. S. Van, 71
Martin, D., on Eucalyptus in the British Isles, 186
Masdevallia muscosa, 270
Masters Memorial Lectures, 1950: The Origin and Improvement of Cultivated plants, by M. B. Crane, F.R.S., A.L.S., V.M.H.—
Part I, 427, **440**
Part II, 466, **477**
Mathewsia foliosa, 164
Matthiola incana, 392, 468
tristis, **445**
Maxwell, Sir Herbert, 14
McDouall, K., 145
McKay, Robert, on A physiological breakdown in Tomatoes caused by high temperatures in 1949...288
McKay, Robert, on "Tomato Diseases," reviewed, 460
McRae, Mr., 162, 282
Meconopsis aculeata, 228
Baileyi, 227
bella, 228, **236**, 309
betonicifolia (Tibetan Poppy), **110**, 153, 198, 220, 227, 237
Delavayi, 228
Dhwojii, 227, 302, 307
discigera, 153, 313, **317**
gracilipes, 154
grandis, 153, 198, 227, 228, 237
horridula, 154, 312
integrifolia, exhb., lxxxvii, 151, 328
latifolia, 153, 228
longipetiolata, 154, 227, 302, 312, **317**
× Musgravei, exhb., lxxxvii
paniculata, 153, 307, **316**
quintuplinervia, exhb., lxxxvii 151, **155**, 228, 237
regia, 227, 302
robusta, 154
× Sheldonii, 227
Sherriffii, 227, 228
simplicifolia, 89, 153, 228
superba, 153
torquata, 313
villosa, 154
violacea, 154
Meconopsis × Sheldonii by Cicely M. Crewdson, 198
Meeuwen, G. B. V. Ltd., 361
Melianthus major, 301, 316
Menzies, Archibald, 207
Menziesia ciliicalyx, 152, 155
var. eglandulosa, exhb., lxxix
ferruginea, 155
lasiophylla, 155
purpurea, 153, 155
Merodon equestris, 331
Mertensia sibirica, 260

Mertensia viridis var. coriacea, exhb., lxxix
Messell, Lt.-Col., L. C. R., 14, **26**, 280
Metasequoia glyptostroboides, 265
Metasequoia glyptostroboides, The Vegetative Reproduction of, by Major Albert Pam, O.B.E., M.A., F.L.S., V.M.H., 359
Metcalfe, C. R., and L. Chalk, on Anatomy of the Dicotyledons, reviewed, 455
Metrosideros floribunda, 464
Meyer, The Rev. Canon Horace Rollo, V.M.H., xxii, **67**
Michael, A. D., 69
Michelia Doltsopa, exhb., lxxii, lxxxi
floribunda, exhb., lxxii
"Michurin I. V.: Selected Works," reviewed, 369
Milner, Messrs., 262
Missouri Botanical Garden Bulletin, 75
Mitella pentandra, 153
Mitraria coccinea, 329, 440
Moles and Worms, xxxiix
Moore, Sir Frederick and Lady, 8, 319, 320
Moore, Mr. H. Arnytage, 237, 238, 322
Moore, W. C., on Grey Bulb rot of Tulip, 113
Moraea gigandra, 325, 326
var. purpurea, 326
glaucopis, 325
iridioides, 219
papilionacea, 323
pavonia var. magnifica, **316**
sp., distribution of, 23
tripetala, 323
tulbaghensis, 325
villosa, **316**, 324, 325, 326
× M. gigandra var. purpurea, **316**
× M. pavonia, 325
Moraeas, Peacock, by T. T. Barnard, 323
Moreton, B. D., "Guide to British Insect," reviewed, 458
Moricandia Ramburii, 482
Moscharia pinnatifida, 249
Moschosma riparium, 301
Muir, Mrs., 8
Mulligan, Brian O., on The White-bark Pine, 197
Mundkur, R. B., on "Fungi and Plant Disease," reviewed, 371
Murray, P. D. F., M.A., D.Sc., "Biology, an Introduction to Medical and other Studies," reviewed, 459
Musa Basjoo, 246
fertilis, 301
Muscari Pinwillii, 330
Tubergenianum, **A.M.** April 18, 1950, exhb., lxxviii
Musgrave, Charles, 106
"Mushroom Growing to-day," by F. C. Atkins, reviewed, 456
Mussin-Pushkin, Count Apollos Apollosovich, 403
Mutisia decurrens, 247, 438
ilicifolia, 248
oligodon, 248
retusa, 248
Mutisia subulata, 248
Myddleton House, Viburnum fragrans at, 60
Myosotidium nobile, 438, **441**
Myrceugenia apiculata, 205
Ugni, 205
Myrtus apiculata, 205, 360
Cheken, 206
communis, 440
Lechleriana, 205, 238, 355, 357
Luma, 205, 239, 355, 360, 442
persicae, 351, 352, 353
Myrtus Lechleriana by W. Arnold-Foster, 360

Narcissus Actaea, **A.M.*** April 14, 1950, exhb., lxxvii, 334
Agnes Montefiore, **A.M.** 1947—333
Alight, 331
Ambule, **A.M.** 1936—332
Angmering, 333
Arcadia, 333
asturiensis, 55
Ataturk, 331
Aurelia, **A.M.** 1936—333
Bahram, exhb., lxxiii
Bartley, **F.C.C.** 1949—333
Bastion, exhb., selected for trial, lxxxi
Beirut, exhb., lxxiii
Bethia, 334
Beryl, **A.M.** 1936—333
Bodilly, **F.C.C.** 1949—333
Bokhara, 332
Boswin, **A.M.** 1936—332
Brandon, **A.M.** 1936—332
Bridget Hill, 332
Broadwater, **A.M.** April 4, 1950, exhb., selected for trial, lxxiii, 254
Broussonetii, exhb., xxxix, lv
Brunswick, **A.M.** 1947—333
Bulbocodium, exhb., lxvi, 66, 449
monophyllus, 64
Romieuxii, 64
Buttermilk, **H.C.** 1936—333
calcicola, 55, 451
Carbineer, **A.M.** 1940—332
Cargan, **A.M.** May 2, 1950, exhb., lxxxi, 292, 331
Charity May, exhb., selected for trial, lxxiii
Charles I, **A.M.** 1939—332
Chatsworth, **A.M.** 1949—332
Cheerfulness, **F.C.C.** 1939—333
Cheerio, 332
Cicely, **A.M.** 1936—333
Clusii, 64
Contour, **A.M.** May 2, 1950, exhb., lxxxi, 292
Coverack Glory, **H.C.** 1936—332
Crocus, **A.M.** 1947—332
Cromarty, **A.M.** 1949—332
cyclamineus, 66, 85, 144, 443
Damson, 331
Dandy Boy, **A.M.** 1947—332
Decency, **F.C.C.** 1944—332
Denys Mever, **A.M.** 1947—333
Dinkie, **A.M.** 1936—333
Edith Amy, exhb., lxxiv

Narcissus, Emperor, 432
Eva, **A.M.** 1936...333
Fair Lady, **A.M.** 1931...334
Fairy Wings, **C.** 1941...333
Farewell, **H.C.*** April 14, 1950, exhb., lxxvii, 332
Favell Lee, **H.C.** 1947...333
Feu de Joie, **A.M.** 1944...333
Fingal, **A.M.** 1946...332
Firemaster, **A.M.** April 13, 1950, exhb., lxxiv, 254
Firework, exhb., selected for trial, lxiii
Flamenco, **A.M.** 1949...333
Folly, **F.C.C.** 1936...333
Fortune, **A.M.** 1947...332
Frigid, **F.C.C.** May 23, 1950, exhb., **A.M.**, lxxxviii, 416
Galilee, exhb., lxxxii
Garibaldi, **A.M.** 1936...332
Garron, **A.M.** 1946...332
General Smuts, exhb., selected for trial, lxvi
Glenmanus, exhb., lxxxii
Glenravel, **H.C.** 1946...332
Glenshesk, **A.M.** April 13, 1950, exhb., lxxiv, 254
Glorious, **A.M.** 1936...334
Godolphin, **A.M.** 1949...332
Golden Ducat, **A.M.** April 18, 1950, exhb., lxxviii, 254
Harvest, 331
Perfection, **A.M.** 1944...334
Ray, **A.M.** 1947...332
Sceptre, **F.C.C.** 1936...333
Spur, 432
Goring, **A.M.** 1949...332
Grayling, **A.M.** 1936...333
Greenshank, exhb., selected for trial, lxvi
Gulliver, **A.M.** 1947...333
Happy Easter, 333
Havelock, **F.C.C.** 1936...332
Heaven, exhb., lxxiii
hedrianthus, 449
Helios, **A.M.** 1936...332
Henry Irving, 432
Hera, **A.M.** 1936...333
Hesla, **A.M.** 1936...334
His Excellency, **H.C.*** March 31, 1950, exhb., lxxvii, 331
Interim, exhb., lxxxii
Irish Luck, exhb., lxxiii
Jenny, **F.C.C.** April 4, 1950, exhb., selected for trial, lxxii, lxxiii, 254
John Evelyn, exhb., lxiii
Peel, 333
jonquilla, 451
Jubilant, **F.C.C.** 1944...332
Kandahar, **A.M.** 1947...332
Killigrew, **A.M.** 1936...332
King Alfred, 432
King's Ransom, **P.C.**, exhb., lxxiv
Kingston, 331
Laddie, exhb., lxxiv
Lady Betty, 333
Lanarth, **F.C.C.** 1936...334
Leslie Hulbert, **A.M.** 1946...333
Lieut. H. Hodges, **H.C.** 1949...332
longispathus, 448
Narcissus, Lucombe, 332
Marion Cran, **A.M.** 1936...332
Market Merry, **F.C.C.** April 14, 1950, exhb., lxxvii, 333
Marksman, **A.M.** 1947...332
Marmora, **F.C.C.** 1936...333
Mary Copeland, **A.M.** 1936...333
Matapan, exhb., lxiii
Milkmaid, **H.C.** 1936...333
Ming, **H.C.** 1936...333
minimus, 55
Moonstruck, exhb., lxxiv
Mount Hood, 331
Mrs. E. C. Mudge, **A.M.** 1936...332
Ernst H. Krelage, **A.M.** 1944...332
William Copeland, **A.M.** 1944...333
Mulrany, **A.M.** April 4, 1950, exhb., lxxiii, 254
Musketeer, **A.M.** 1941...332
Nanny Nunn, **H.C.** 1936...333
nanus, 55, 440, 443
Nimrod syn. Carlton, **F.C.C.** 1939, 332
Niphetos, 333
Nissa, **A.M.*** March 31, 1950, exhb., lxxvii, 332
Niveth, **H.C.** 1936...333
Olympic Torch, 332
Orange Bird, **A.M.** 1947...332
Crinoline, 333
Glory, **A.M.** 1936...333
Pacific, **A.M.** 1946...332
Patching, 331
Penberth, 331
Petsamo, **A.M.** April 4, 1950, exhb., lxxiii, 255
Pepper, **C.** 1939...332
Poetaz Cragford, exhb., xl
Polindra, **A.M.*** April 14, 1950, exhb., lxxvii, 332
Prince, **A.M.** 1944...333
Princeps, 276
Principal, 332
Red Defiance, **A.M.** 1936...332
Reprieve, exhb., lxxxviii
Rewa, **A.M.** 1946...333
Riffianus, 64
Rippling Waters, **F.C.C.** 1947...333
Rosario, exhb., lxxiv
Roselene, **H.C.** 1949, exhb., selected for trial, lxxiv, 332
Rouge, 332
Royal Mail, exhb., selected for trial, lxxiii
Roxane, **A.M.** 1936...332
rupicola, 451
Rustom Pasha, **A.M.** 1949...332
Sandringham, **H.C.** 1947...333
Santa Claus, **A.M.** May 23, 1950, exhb., lxxxviii, 416
Sarchedon, **A.M.** 1944...334
Scarlet Gem, **F.C.C.** 1936...334
Scarpa, **A.M.** 1949...332
Sea Shell, **A.M.** 1944...333
Severn, exhb., lxxiv
Shipmate, exhb., lxxxii
Silver Bugle, **A.M.** 1949...333
Circle, 333
Snow Queen, **F.C.C.** 1947...333

Narcissus Solferino, **A.M.** 1936—332
Spellbinder, exhb., lxxiv
St. Ives, **A.M.** 1939—332
St. Keverne, **A.M.** March 21, 1950, exhb., lxvi
Sulphur Prince, **A.M.** 1939—332
Sunproof Orange, 332
Sunstar, 333
Tazetta, exhb., lvi
elatus, exhb., lvi, lviii
Tornamona, exhb., lxxiv
Tredore, 333
Trevisky, 332
Trevithian, **F.C.C.** 1936—334
triandrus, exhb., lxix
aurantiacus, exhb., lxiii
Tudor Minstrel, **A.M.** April 13, 1950, exhb., lxxiv, 255
Tunis, **F.C.C.** 1936—333
Turin, 333
Ucluluet Gem, 333
viridiflorus, exhb., xxxix, xl
Virtue, **A.M.** May 2, 1950, exhb., lxxxi, 292
Warlock, **F.C.C.** 1939—333
Wee Bee, 333
White Empire, exhb., lxiii
Whiteley Gem, 332
White's Hybrid, **A.M.** 1939—334
Wrestler, **A.M.** 1936—332
Yellow Beauty, **H.C.** 1936—332
Poppy, **A.M.** 1947—332
Prize, **A.M.** 1936—334
Ypsilante, **A.M.** 1949—334
Zeeland, **A.M.** 1947—333
Narcissus at Wisley, 1948–1950—331
Narcissus, susceptibility to Grey Bulb rot, 116
National Vegetable Research Station, 54
Nectarine Lord Napier, 473
Neergaard, P., work on Alternaria senecionis, 201
Nepal, His Highness the Maharaja of, 302
Nepal, An expedition to, by O. Polunin, M.A., F.L.S., 302
Nepal, Map showing route in, 305
Plant Collecting in, **317**
The Mountains of, **316, 317**
Nepeta caerulea, 405
Faassenii, **397,** 404, 405, 406
grandiflora, 404
longiflora, 403
Mussinii, **397,** 403, 404, 405, 406
Nepetella, 404
pseudomussinii, 404, 405
Nepeta Mussini and N. × Faassenii, by William T. Stearn, 403
Nerine Bowdeni, 21, **26,** 341, 376
Fenwick's variety, 21, **26**
filifolia, **A.M.** Oct. 18, 1949, exhb., xii, 44
var. pauciflora, xii
flexuosa, exhb., lv
Inchmery Elizabeth, **A.M.** Oct. 18, 1949, xxxvi, 135
Kate, **A.M.** Oct. 18, 1949—135
Mrs. Clarke, exhb., xxxviii
Nena, **A.M.** Oct. 18, 1949, xxxvi, 135
Nerine Stephanie, **A.M.** Nov. 1, 1949, exhb., xxxviii, 136
Nerium Oleander, 339
Nertera depressa, 208
Nicol, Walter, 389
Nicotiana glutinosa, 350, 351, 352, 353, **355**
Nierembergia caerulea, 221
rivularis, 250
Nolana atriplicifolia, 250
lanceolata, 250
paradoxa, 250
tenella, 250
Nomocharis aperta, 227
Farreri, 227
Mairei, 227
nana, 308
pardanthina, 227, 399
saluenensis, 227
Notholirion campanulatum, 227
macrophyllum, 307, 314, **316**
Thomsonianum, 227
Notes from Fellows, 108, 156, 197, 359, 397, 488
Notes on a few plants from S.E. Tibet, by George Taylor, D.Sc., 87
Nothofagus antarctica, 319, 355
betuloides, 355
Dombeyi, 246, 319, 321, 354, 355
fusca, xxxix
nitida, 355
obliqua, 246, 355
pumilo, 355
Nut Knight's Filbert Seedling, exhb., x
Nymphaea gigantea, exhb., vii, 75, 76
forma alba, 76
Nymphæa gigantea alba, by R. S. Trickett, **67,** 75

Ochna multiflora, 219
Odontioda Gera (Oda. Uvalda × Oda. Pittiae), **A.M.** 1949, exhb., lvi, 136
Lita var. Neon (Oda. Marie Antoinette × Oda. Pittiae), **A.M.** April 4, 1950, exhb., lxxiii
Lola (Oda. Sapphira × Oda. Argia), **A.M.** Feb. 14, 1950, exhb., lx, 294
Marispum var. Dainty (Oda. Marie Antoinette × Odm. crispum), **A.M.** June 13, 1950, exhb., xciii, 416
Odontoglossum Aldonia var. Colossus (Alperor × Tordonia), **P.C.** March 7, 1950, lxiii
Elise var. Gloria (Ascania × triumphans), **A.M.** April 4, 1950, exhb., lxxiii, 294
Jenny Strauss (Perryanum × Purple Emperor), **A.M.** Jan. 31, 1950, exhb., lviii, 294
Odontonia Mandania (O. Mandelia × Odontoglossum Ascania), **P.C.** 1949, exhb., xii
Mary var. Chromos (Brimstone Butterfly × triumphans), **A.M.** May 23, 1950, exhb., lxxxviii, 416

Odontonia Princess Elizabeth (Faustina × crispum) **A.M.** June 13, 1950, exhb., xciii, 416
Odontospermum maritimum, 483
Oenothera acaulis, 162, 206
var. aurea, 206
Bertolonii, 206
odorata, 206
sulphurea, 206
triloba, 206
Olea fragrans, 241, 356
Olearia Haastii, 14, 444
macrodentata, 441
nitida var. capillaris, exhb., lxxxvii
semidentata, 441, 442
Omphalogramma, 229
brachysiphon, 229, **236**
elegans, 229
Elwesiana, 229
Farreri, 229
Souliei, 229
vinciflorum, 152, **154**, 229
Ononis speciosa, 482
Onosma Waddellii, 228
Opuntia echinocarpa, 391
Orchid, The, Committee, 1
Orchid Growers Association, 4
"Orchids and How to Grow Them," by Adelaide C. Willoughby, reviewed, 490
Orchids for the Week-end Gardner, by David F. Sander, 269
"Orchids their Description and Cultivation," by Charles H. Curtis, reviewed, 490
Orchids, Awards to, in 1949...45, 136
Orchis foliosa, 153, 220, 246, **317**, 328, 330
praetermissa, 154
Oreocharis sp., 225
Origanum microphyllum, 195
"Ornamental Trees, The Care and Repair of," by A. D. C. Le Sueur, reviewed, 47
Ornithogalum thyrsoides, exhb., lxxix
Orobanche apiculata, 420
minor, 420
sp. in Andalucia, 447
Orphanidesia gaultherioides, 152
Orto Botanico, Padua, The, by Hugh Farmar, 475
Osmanthus Delavayi, 85, 238, 267, **277**, 443
Osmunda regalis, 319, 441
Ourisia coccinea, 280
elegans, 153, 280
macrophylla, 151, **155**
Pearcei, 280
Oxalis adenophylla, **155**, 167, 174
Bowei, 339
carnosa, 167
enneaphylla, 152
rosea, 152
gigantea, 167
lobata, 167
magellanica, 167
obtusa, exhb., lxix
rosea, 167
valdiviensis, 167
Oxydendron arboreum, 155, 301, 377
Padua, The Orto Botanico, at, by Hugh Farmar, 475, **477**
Paeonia arietina Hilda Milne, **A.M.** May 23, 1950...418
var. **A.M.** 1950, exhb., lxxxvii
Broteri, 448
Cambessedesii, **A.M.** 1935, exhb., lxv, lxxviii
Clusii, exhb., lxxvi
lutea, 90
Mairei, 90, **110**
Potaninii, 108
sp. **A.M.** 1950, exhb., lxxxvii
Pam, Major Albert, O.B.E., M.A., F.L.S., V.M.H., on Further Notes on Worsleya, 20
a yellow flowered form of Paeonia Potaninii, 108
on The Vegetative Reproduction of Metasequoia glyptostroboides, 359
Paraquilegia anemonoides, 222
Paris quadrifolia, 152
Parnassia nubicola, 154
Parrotia persica, 423
Parsley Champion Curled, **A.M.** April 28, 1950...409
Champion Moss Curled, 409
Double Curled Asco, 409
Evergreen, 409
Exhibition, 409
Extra Fine Curled, 409
Moss Curled, 409
Triple Curled, 409
Imperial, **H.C.** April 28, 1950...409
Moss Curled Improved, 409
Multicurl, 409
New Dark Green Winter, 409
Paramount, 409
Peerless, 409
Perennial Moss Curled, **A.M.** April 28, 1950...409
Perono Special, 409
Parsley at Wisley, 1949...409
Pasithaea coerulea (the Pajarites), 287
Passiflora coerulea, 438
Paulownia Fortunei, exhb., lxxv, lxxvi
imperialis, 316
tomentosa, 238
Pea, Late Culinary, Admiral Beatty, 41
Ambition, **A.M.*** July 7, 1949...40
Aristocrat, **H.C.*** July 7, 1949...40
Duke of Albany, 41
Emerald, 41
Evergreen, **A.M.*** July 7, 1949, 40
Felpham Last Crop, **A.M.*** July 7, 1949...40
Gladstone, 41
Invicta, 41
Kelvedon Hurricane, 40
Viking, **H.C.*** July 7, 1949...40
Later Onward, No. 2...40
Liberty, 41
Lord Chancellor, 41
Majestic, 41
Ormskirkian, 41
Phenomenon, 40
Pride of Kent, 41
Rondo, 40

Pea, Late Culinary, Standard, H.C.* July 7, 1949—41
Strimar, H.C.* July 7, 1949—41
Peach Bushwood Beauty, exhb., l
Climaden, exhb., i
Humboldt, 329
Royal George, 329, 473
Sea Eagle, 329
Seedling, exhb., i, vi, cv
Pear Conference, 466
Fertility, 466
Seedling, exhb., xxxvii
Pearce, Richard, 162, 163, 166, 247, 250, 280
Peas, Late Culinary at Wisley, 1949—40
Peat Garden, The, by A. Evans, 145
Pedicularis megalantha, 314
Sculleyana, 314
Pelargonium abrotanifolium, 196
capitata, 196
crispum, 196
variegatum (Lady Plymouth), 196
exstipulatum, 196
fragrans, 196
graveolens, 196
obtusilobum, 195
odoratissimum, 196
quercifolium major, 196
radula, 196
Scarboroviae, 195
Shrubland Pet, 197
tomentosum, 197
Vivid, exhb., cii
Peltiphyllum (Saxifraga) peltatum, 318
Penstemon alamosensis, exhb., lxxxvii
campanulatus Evelyn, exhb., lxxxvii
Clutei, exhb., lxxxvii
congestus, exhb., xc
fruticosus var. crassifolius, exhb., xc
Hartwegii Garnet, exhb., lxxvii
utahensis, exhb., lxxxvii
Perezia linearis, 249
multiflora, 249
Perkins, J., 244
Pernettya empetrifolia, 155
furiens, 249
leucocarpa, 155
mucronata, 153, 155, 249
Pentlandii, 249
prostrata, 155
pumila, 155
rupicola, 153
tasmanica, 155
Perowskia atriplicifolia, 299
Petre, Lord, 85
Petrocosmea sp., 225
Petteria ramentacea, exhb., lxxxvii
Petunia Fire Chief, exhb., selected for trial, xcviii
Pfitzer, P. and L. Jelitto, "Dahlien im Garten und im Haus," reviewed, 457
Phaedranassa viridiflora, exhb., lxx, lxxii
Philadelphus × cymosus, 209
× grandiflorus, 209
× Lemoinei, 209
× Norma, 209
Philageria Veitchii, 238, 286
Philesia buxifolia, 238, 286, 330, 440
magellanica, 154
Phillipi, Prof. R. A., 164, 204
Phillippia sp., distribution of, 23
Phlomis crinita, 481
purpurea, 481
Phlox argillacea, 220
canadensis, 220
carolina, 300
Drummondii, 300
mesoleuca, 174
Newberryi, 174
paniculata, 353, 355
Scouleri, 174
stolonifera var. Blue Ridge, P.C. 1949 exhb., lxxix
Phoenix canariensis, 331
Phormium atropurpureum, 438
aureo-striatum, 438
tenax, 321, 438
Phycella ignea, 285
Phygelius capensis, 440
Physostegia virginia Vivid, 376
Phytophthora infestans, 288, 472
Phycella ignea, 162
Phyllodoce aleutica, 152
caerulea, 152
empetriformis, 152
Phytoptus vitis, xii
Picea Breweriana, 58, 66, 240, 319
Engelmannii, 244
lasiocarpa, 437
morrisonicola, 240
nobilis, 437
Nordmanniana, 437
Omorika, 319, 321
Pinsapo, 437
Smithiana, 240
spinulosa (morindoides), 237
Pieris floribunda, 85, 150
Forrestii, 362
japonica, 56, 85, 193, 330
ovalifolia, 153
sp. McL.AF. 323, exhb., lv
taiwanensis, 85
Piesse, Claude, I., on The Life of a Variety, 113
Pimelea ferruginea, exhb., lxxxi
Pine, The White-bark, by Brian O. Mulligan, 197
Pinguicula caudata, 221
vallisneriifolia, 446
Pink Allwoodii Betty, H.C.* June 22, 1949—30
Eva H.C.* June 22, 1949—30
Isobel, H.C.* June 22, 1949—30
Jean, H.C.* June 22, 1949—30
Joan, A.M.* June 22, 1949—30
Monty, H.C. June 22, 1949—31
Susan, H.C.* June 22, 1949—31
Victor, F.C.C.* June 22, 1949—30
Winston, A.M.* June 22, 1949—30
Dad's Favourite, A.M.* June 22, 1949. 30
Lilac Musgrave, H.C.* June 22, 1949. 30
London Girl, A.M.* June 22, 1949. 30
Poppett, H.C.* June 22, 1949—31
Murray's Laced Pink, H.C. June 22, 1949—31

Pinks, Garden at Wisley, 1949 30
Pinus albicaulis, **193**, 197, 198
Armandii, 239
Ayachahuite, 321
Cembra, 198
Clusiana, 449, 450
insignis, 264, 437
Jeffreyi, 244
montana, 437
Montezumae, **237**, 246, 321
glaucous form, **A.M.** Oct. 4, 1949, exhb., xi, **26**, 44
Hartwegii, 239
muricata, 149
parviflora glauca, 239, 321
patula, 321
pumila, 198
radiata (Pinus insignis), 58, 237, 264, 321
Roxburghii (longifolia), 304, 312
sylvestris, 479
aurea, 239
var. nevadensis, 480
Wallichiana (P. excelsa), 304
Pinwill, Lt.-Col. W. R., 331
Pinwill, Capt. William Stackhouse Church, **317**, 327, 328, 329, 330
Pinwill, Rev. W. J., 327
Pinwill, Miss E. M., 330, 331
Pittman, Mr., B.A., B.Sc., 112
Pittosporum daphiphylloides, exhb., lxxxvii
Tobira, 316
Pittosporums, 239
Place, Frances, 162
Plagianthus betulinus, 329
Lyalli, 442
Plagiorhegma dubium, 150
Plantago nivalis, exhb., lxi
Plant Collecting in the Mountains of Andalucia, by Vernon H. Heywood, B.Sc., 444, 478
Plant Hunting, Amateur, in the Andes, by M. W. Spitta, 354
"Plant Hunting in Europe," by Dr. Hugh Roger-Smith, reviewed, 336
Plant Reactions to Chemical and Physical Changes, by Dr. Louis E. Blanchard, 390
"Plant Viruses and Virus Diseases," by F. C. Bawden, reviewed, 455
"Plants, British, Drawings of," by Stella Ross-Craig, reviewed, 211
"Plants, Manual of Cultivated," by L. H. Bailey, reviewed, 137
Plants to which awards have been made, 1949 and 1950 43, 135, 254, 291, 334, 410, 453, 496
Plants, The Origin and Improvement of Cultivated, by M. B. Crane, F.R.S., A.L.S., V.M.H., 427, 465
Platycerium alcicorne, 301
Platycodon grandiflorus, 154
Pleione Pricei, **A.M.** 1920, exhb., lxxix
Plum Thames Cross, exhb., i
seedling, exhb., cv
Plumbago capensis, 339
rosea, 422, 463
"Plums of England, The," by Dr. H. V. Taylor, C.B.E., V.M.H., reviewed, 255
Pochin, Henry Davis, 262
Podocarpus chilina, 321
nubigena, 319
sp. in Chile, 162
Polemonium pauciflorum, 300
Polunin, O., M.A., F.L.S., on An Expedition to Nepal, 302
Polyanthus Admiration, exhb., lxxvi
Polygala Vayredae, 152
Polygonatum multiflorum, exhb., lxxxvii
Polygonum affine, 300, 340, 377
Griffithii, 229
sphaerostachyum, 229
vaccinifolium, 229, 300, 377
"Ponds and Fish Culture for Pleasure and Profit," by C. B. Hall, reviewed, 256
Pontederа Guilio, 477
Pontederia cordata, 259
Popham, W. J., 161
Populus Maximowiczii, 239, 246
Wilsonii, 239, 246
Potato Golden Wonder, 429, 430
Langworthy, 429
Sprouting, exhb., c
Potentilla caulescens var. villosa, 446, 452
coriandrifolia, 302
fruticosa, 197
var. Farreri, 15
var. parvifolia, 15
Powerscourt, Seventh Viscount, 243
"Practical Lawncraft," by R. B. Dawson, reviewed, 49
Pratia repens, 249
Treadwellii, 154
Primula alpicola, 154, 220
Amethystina, 87
amoena, 150
anisodora, 154
apoclita, 151
atrodentata, 310
aurantiaca, 154
auresta, 229
Auricula, 387
albocincta, 387
Bauhini, 387
ciliata, 387
Beesiana, 154
bhutanica, 149, **154**, 229
bracteosa, 149, **154**, 229
Bractworth (P. bracteosa × P. Edgeworthii), **P.C.** 1949, **A.M.** March 7, 1950, exhb., lxiv, 414
Bulleyana, 154
burmanica, 151
buryana, 302, 309, 310
Calderiana, 151
capitellata, 151
chionantha, 151
chionata, 88
chungensis, **110**, 151, 219
Clarkei, 150
cockburniana, 153
concinna, 310
Coral Pink, 252
cortusoides, 150
Crimson Glow, 251
Star, 251
denticulata, 56, 149, 310
alba, 149

Primula denticulata Ascot Hybrids, exhb., lxxiii
Dickieana, exhb., xc, 87, 88, 89, **110**
eburnea, **A.M.** May 2, 1950, exhb., lxxxii, 229, 266, **277**, 415
Edgeworthii (P. Winteri), 229
alba, 149
elatior, 86
Elisiae, exhb., lxxix, 151
falcifolia, 88
flagellaris, 310
Florindae, 259
Forrestii, 266, **277**
frondosa, 86, 150, 154
Giant Crimson, 252
glomerata, 151
gracilipes, 149, 229
helodoxa, 219, 237, 317, 318
hirsuta, 387
involucrata, 151
Jaffreyana, 154
japonica, 144, 151, 219
jesoana, 151
Juliae, 61
Juliana var. Blue Horizon, **P.C.**, Feb. 14, 1950, exhb., lx, lxiii
Kewensis, 435
Kingii, 87
Littoniana, 220
luteola, 153
macrophylla, **236**, 310, **317**
malacoides, exhb., lvii, lviii, lxxvi var., exhb., lix
Pink Delight, exhb., lvii
Margaret (P. Allionii × P. Berninae), exhb., lxix
marginata, 387
megaseaefolia, 149
Mooreana, 154
Morsheadiana, 88
muscarioides, 151
muscoides, 310
nutans, 153, 229, 260
obliqua, 310, 311, 312, **316**
odontica, 87
Orange Glow, 251
Prospect (Wollastonii × Reidii), **P.C.**, May 23, 1950, exhb., xc
pubescens Karen Newberry, exhb., lxxvi
pulverulenta, 151, 219
pusilla, 310, 312
Reidii, 229
reticulata, 310
rosea, 86, 150, 151
rotundifolia, 302, 310
Rowallane Rose, 237
Salmon King, 251
saxatilis, 151, 154
scapigera, 149, 229
scotica, 154
sessilis, 149
Sherriffae, 229
sikkimensis forma Hopeana, 310, **317**
sinensis, exhb., lvii, 4, 467
Crimson Glow, 253
Dazzler, **A.M.** Jan. 10, 1950...252
Double Charm, 252
Dazzler, 252
Primula sinensis Giant Crimson Glow, exhb., selected for trial, lvii
Pink, exhb., selected for trial, lvii
Startler, exhb., selected for trial, lvii
His Excellency, **A.M.*** Jan. 19, 1950, 252
Lachröschen, **A.M.*** Jan. 19, 1950, 252
Loveliness, 252
Pink Enchantress, **H.C.*** Jan. 19, 1950...252
Scarlet King, **A.M.*** Jan. 19, 1950, 252
Schonheit Lachsorange, 252
Single Loveliness, exhb., lvii
Reading Blue, exhb., selected for trial, lvii
stellata, 4
Blue Shadows, exhb., lvii
Crimson Star, **A.M.*** Jan. 19, 1950...253
Enchantress, **A.M.*** Jan. 19, 1950, 253
Fire King, **A.M.*** Jan. 19, 1950, 253
Gaiety, **A.M.*** Jan. 19, 1950...253
Giant Hybrid, 253
Guardsman, **A.M.*** Jan. 19, 1950, 253
Orange Glow, **A.M.*** Jan. 19, 1950...253
Salmon King, **A.M.*** Jan. 19, 1950...253
Queen, 253
Vanguard, 253
Zukunft, 252
sinopurpurea, 151
sonchifolia, 229
sphaerocephala, 154
Startler, 251
strumosa, 309
Stuartii, 310, 311, 312
Symmetry, 252
tenella, **P.C.** May 23, 1950, exhb., xc xcix
tenuiloba, 310
umbratilis (Ludlow and Sherriff 1912), **P.C.** 1939, **A.M.** 1941, exhb., lxxix, xc
Valentiainna, 87, 88
Vesuvius, 252
Viali, 153
Viatans (Viali × nutans), **A.M.** May 23, 1950, exhb., lxxxvii, 418
vulgaris, 150
green-form, exhb., xc
Waltonii, 154
werringtonensis, 154
Wigramiana, 229, 302
Wollastonii, 229, 302, 310, **317**
xanthopa, **P.C.**, July 11, 1950, exhb., xcix
yargongensis, 151, 174
Primula sinensis tried at Wisley, 1949-50, 251
Pring, George H., 75, 76
Prockter, Noel J., on "Simple Propagation," reviewed, 459
Prodromus Florae Nepalensis, 302
Proebstle, Alfred, J., 75

"Propagation, Simple," by Noel J. Prockter, reviewed, 459
Prostanthera rotundifolia, 329
violacea, 329
Proustia pyrifolia, 248
Prumnopitys elegans, 162
Prunus autumnalis, 66
cerasifera, 434, 441, 469
atropurpurea (Pissardii), 67, 358
Conradinae, 66
var. semiplena, 55
Davidiana, 55, 66
domestica, 434, 435, 441, 469
glandulosa albiplena, A.M. May 5, 1950, exhb., lxxxi, 335
Jacquemontii, exhb., lxxvi
Kwanzan, 143
Lannesiana, exhb., lxxii
Oku-miyako, 143
Padus Spaethii, exhb., lxxii
pendula, 66
persica, 473
Aurora, A.M. April 4, 1950, exhb., lxxi, 335
Iceberg, A.M. April 4, 1950, exhb., lxxii, 335
Pink Perfection, exhb., lxxxi
Pollardi, 66
prostrata, Syrian form, exhb., lxxxvii
Sargentii, 20, 66, 67, 143, 377
serrula var. tibetica, 58, 66
serrulata Imosé, exhb., lxxvi
Okiku, A.M. May 5, 1950, exhb., lxxxi, 335
var. spontanea (syn. P. mutabilis), 143
Shiro-fugen, 143
spinosa, 434, 441, 469
plena, A.M. April 4, 1950, exhb., lxxii, 335
subhirtella, 66
autumnalis, 54, 66
var. semi-plena, 66
Fukubana, exhb., lxxii
Ukon, 143
yedoensis, 66, 67, 143, 319
Psoralea grandulosa, 203
pinnata, 242
Ptelea isophylla, 315
Pteridophyllum racemosum, 154
Pterocephalus spathulatus, 452, 480
Ptilotrichum longicaule, 451
maritimum, 483
Reverchonii, 448, 449
spinosum, 449, 450, 479
Puddle, F. C., 263, 267
Pulsatilla, Hygroscopic awn of, xxxvii
vulgaris (Anemone Pulsatilla), xxxvii
Punica Granatum, 19
Puya alpestris, 283, 399, 400, 401, 402
chilensis, 282, 320, 400, 402
coarctata El Cardon, 282
coerulea, 283, 400
pygmia, 401
violacea, 400
Whytei, 399, 400
Puya alpestris in its native land, by W. Balfour Gourlay, 399
Pyracantha atalantioides Haslemere Scarlet, exhb., lix
coccinea var. Lalandii, 20
× Watereri, exhb., xxxvi
Pyrethrum ptarmicifolium, 423
spathulifolium, 449
Pyrola rotundifolia incarnata, 154
Pyrus Eleyi, 441
salicifolia, 319

"Quarter Acre Garden, The," by G. E. Whitehead, reviewed, 49
Quercus coccinea var. splendens, 423
Ilex, 241, 243
pedunculata, 355
semecarpifolia, 304, 312

Radish var. Scarlet Globe, 466
Ramondia Myconi, 153
pyrenaica, 440
serbica, 153
Ramsbottom, Dr. John, O.B.E., M.A., D.Sc., F.L.S., V.M.H., xxii, 67
Ramsden, Sir J., 250
Ranunculus Ficaria grandiflorus, 209
gramineus grandiflorus, exhb., lxxviii
Lyallii, 153, 155, 237
sp., exhb., lxxii
spicatus, exhb., lxxv
Rashleigh, Edward, 187
Reed, Dr. Edwin C., 402
Rehder, Prof., 77, 209
Reinwardtia trigyna, exhb., lxv
Relbunium ovale, 208
Renton, Mr. and Mrs. J., 87, 89
Reseda Gayana, 445
ramosissima, 445
suffruticosa, 445
Reuthe, Mr., 249
Rhamnus cathartica, 420
Rhapithamnus cyanocarpus, 281
Rhinephyllum Broomii, 477, 487, 488
Rhinephyllum Broomii L. Bolus, by Gordon Rowley, 487
Rhododendron Aberconwayi, 153
pink form, exhb., lxxxviii
(a) Addy Wery (malvatica × Flame), A.M. May 5, 1950...406
Alcibiades (Hiraethlyn × F. C. Puddle), exhb., lxxxii
Albatross, 175
ambiguum, 441
Angelo, 175
var. Sheffield Park (R. discolor × R. Griffithianum), A.M. June 13, 1950, exhb., xcii, 410
anthopogon, 152, 309, 313
(a) Apple Blossom (Azuma Kagami), A.M. May 5, 1950...406
arborescens, 220
arboreum, 54, 66, 141, 242, 304, 438, 441
Argosy, 14
Aucklandii, 241, 438
auriculatum, 74, 260

Rhododendron Avalanche var. Alpine Glow (Loderi × calophytum), exhb., lxxvii
Avocet, 175
azaleoides, 220
Azor, 14
barbatum, 152, 306, **441**, **442**
basilicum, exhb., lxxvii
Beauty of Tremough Bodnant form (arboreum × Griffithianum), exhb., lxxvii
Bo-peep (R. moupinense × R. lutescens), 55, 66
Bric-à-Brac (leucaspis × moupinense), 55, 65
Britannia, 238
× discolor, exhb., **lxxxix**
Bud-blast, **237**
bullatum, 68, 86
Bulldog (Earl of Athlone × Elliottii), exhb., lxxxviii
burmanicum, 238
calostrotum, 153
campanulatum, 144, 309, **316**, **441**
campylocarpum, 88, 152, **441**
× Thomsonii, 441
campylogynum, 153
canadense, 152, 155
cantabile, 152
(a) **Carolina**, exhb., selected for trial, lxxxviii
Caroline Spencer (Fortunei × Williamsianum), exhb., lxxviii
cerasinum, 89
Championae, exhb., lxxxii
charitopes, 89
Chiron (Barclayi × haematodes), exhb., lxxvii
Choremia (haematodes × arboreum), **F.C.C.**, 55, 66
Christmas Cheer, 54
Chrysaspis, 65
chryseum, 144
ciliatum, 65, 150, 152
ciliicalyx, 68, 86
Cilpinense, 65, 150, 267, **277**
cinnabarinum, 319
cinnamomeum, 306
(a) **Clarissa**, exhb., selected for trial, lxxxviii
(a) **coccinea speciosa**, 242
Conroy (cinnabarinum var. Roylei × concatenans), **A.M.** May 23, 1950, exhb., lxxxviii, **397**, 410
× Corona (Choremia × chaetomallum), 55
Cornubia, 66, 442
Countess of Haddington, **441**, **442**
Sefton (Edgeworthii × multiflorum), exhb., lxxvii
crebriflorum, 88
crinigerum var. **euadenium**, exhb., lxxxviii
croceum, **A.M.** 1926, exhb., lxxxix, 319
cyanocarpum, 152
cyclium, 153
Cynthia, 238
Dalhousiae, 442
Dawn, **A.M.** May 5, 1950...406
Rhododendron decorum, 241, 441
delessense, exhb., lxxxii
diaprepes, 25
discolor, 14
drumonium, 153
elaeagnoides, 308
Elliottii, 241
Elsae, 438
× eximium, exhb., lxix
Evening (Hodgsonii × Mansellii var. Muriel), exhb., lxxvii
eximium, 442
(a) **Exquisita**, **A.M.** May 31, 1950...406
Falconeri, 240, 319, 329, 438, 442
Fascinator (Hirsuthlyn × repens), **A.M.** April 4, 1950, exhb., lxxvii, 410
fastigiatum, 153
fastuosum flore pleno, 238
fictolacteum, 152, 240, 442
Forrestii, 88
Francis Hanger (dicroanthum × Isabella), **A.M.** June 27, 1950, exhb., xcvi, 410
fulgens, 438
fulvum, 319
Fusilier × Griersonianum, exhb., lxxxviii
Garnet, 238
(a) **Ghent Daviesii**, 237
Gibsonii, 442
Gillian Spencer, exhb., lxxviii
var Bodil (haematodes × Ascot Brilliant × neriiflorum), exhb., lxxviii
Gladys var. **Rose** (campylocarpum × Fortunei), **A.M.** May 23, 1950 exhb., lxxxii, 410
(a) **Golden Eye**, exhb., selected for trial, lxxxviii
Golden Oriole, 65
grande, 319
Grandex (eximium × sinogrande), exhb., lxxvii
Griersonianum, 221, 241, 319, 442
Griffithianum × arboreum, blood red, exhb., lxxxix
× R. Fortunei, 144
× The Don, exhb., lxxxviii
haematodes, 319
Hawk var. **Exbury** (Wardii × Lady Bessborough), exhb., lxxxviii
var. **Kestrel** (Wardii × Lady Bessborough), exhb., lxxxix
var. **Merlin** (Wardii × Lady Bessborough), exhb., lxxxviii
hippophaeoides, 152
Hodgsonii, 442
(c) **Homebush**, **A.M.** May 31, 1950...407
ianthinum, 238
impeditum, 144, 153
imperator, 153
inaequale, 86
Inamorata (Wardii × discolor), **A.M.** June 27, 1950...xcvi, 411
intricatum, 144, 150, 152
irroratum, 55
Janet (Dr. Stocker × Avalanche), **A.M.** exhb., April 4, 1950, lxxvii, 411

Rhododendron Jan Steen (R. Fabia × R. Lady Bessborough), **P.C.**, exhb., xcii
keleticum, 152
Kewense, 144
Keysii, 319
Kiev (Barclayi × Elliotii), **A.M.** May 2, 1950, exhb., lxxxii, 411
(a) Knap Hill Pink, **A.M.** May 31, 1950...407
(Kurume) Phyllis Elliott, exhb., selected for trial, lxxxii
lacteum, 442
Lady Bessborough, 175, 319
Chamberlain, 237
Lady Bird, 175
lapponicum, 152
Lavender Girl (Fortunei × Lady Grey Egerton), **A.M.** May 31, 1950...407
Leo (Elliottii × Britannia), exhb., lxxxviii
lepidostylum, 155
lepidotum, 307
leucaspis, 55, 65, 150, 152
litiense, 319
× Grierdal, exhb., lxxxix
Loderi, exhb., lxxx, 144, 175
lutescens, 54
luteum (Az. pontica), 440
Macabeanum, exhb., lxix
magnificum, **A.M.** March 21, 1950, exhb., lxix, lxxvii, 411
(a) malvaticum × Kaempferi, 174
Mariloo var. Eugenie (Dr. Stocker × lacteum), **A.M.** April 4, 1950, exhb., lxxvii, 411
(a) Marion Merriman, **A.M.** May 31, 1950...407
May Morn red form (May Day × Beanianum), exhb., lxxvii
mekongense, 88
mishmiense, exhb., lxxxii
Morawen (Isabella × Shepherd's Delight), **A.M.**, May 23, 1950, exhb., 411, [lxxxviii
moupinense, 65, 149, 150
mucronatum, 4, 377, 464
mucronulatum, 59, 60, 149, 150
var. magnificum, exhb., selected for trial, lxxxviii
(a) Mustard, **A.M.** May 31, 1950...407
myrtilloides, 153
neriiflorum, 152, 153, 441, 442
× Tally-Ho, exhb., lxxxix
niveum, 144, 441
× nobleanum, 54
(a) Nos. R.2, P.1, B.61, B.61(A), exhb., selected for trial lxxxviii
Nuttallii, 242
× formosum, 330
Nymph, exhb., lxxvii
obtusum var. japonicum, 143
orbiculare, exhb., lxxxix, 321
oreodoxa (The Glory of the Mountains), 150
oreotrephes, 152, 319, 438
paludosum, 88
pemakoense, 153
Penjerrick, 265
Perseverance (Lady Chamberlain × cinnabarinum), exhb., lxxxviii
Rhododendron Polar Bear (auriculatum × diaprepes), 14, 260
ponticum, 174, 317, 318, 437, 438, 442, 443, 444
praecox, 56, 66
praevernum, exhb., lxxvii
prostigiatum, 152
prunifolium, **A.M.** Aug. 1, 1950, exhb., cii, 490
quinquefolium, 152
racemosum, 152
radicans, 153
Red Admiral, 66
repens chamaedoxa, 153
chamae-Thomsonii, 152
Repose (lacteum × discolor), exhb., lxxxviii
Retreat, exhb., xcvi
Reverie, exhb., xcvi
rhabdotum, exhb., xcvi, 242
Rhythm (aperantum pink form × repens), exhb., lxxvii
Romany Chal × Griersonianum, exhb., lxxxii
Rouge (R.T.L. 1249 × R. Elliottii), **A.M.** June 1950, exhb., xcii, 412
Royal Purple, 441
saluenense, 153
Scandinavia (Hugh Koster × Betty Wormald), **A.M.** May 31, 1950...407
scintillans, 153
setosum, 309
Shilsoni, 66
sinogrande, 240, 329, 440, 442
Sir Charles Lemon, 442
Souliei, exhb., lxxxix, 153
Spinbur (spinuliferum × burmanicum), exhb., lxxxii
sutchuenense, exhb., lxix, lxxvii, 441
× Tessa (praecox × moupinense), 55, 66
Thais (Eurydus × Loderi), exhb., lxxxviii
Thayerianum, exhb., xcvi
Theresa (Romany Chal × Griersonianum), exhb., lxxxviii
Thomsonii, 66, 240, 241, 317, 319, 329, 438
Trewithen Orange (Full House × concatenans), **F.C.C.** April 4, 1950, exhb., lxxvii, 412
tsangpoense, 153
Victorianum, 317
viscosum, 220
Wardii, 144, 319
White Wings, 464
Wightii, 442
Williamsianum, 152
Winsome (Humming Bird × Griersonianum), **A.M.** May 23, 1950, exhb., lxxxviii, **397**, 412
yunnanense, 238, 441, 442
zeylanicum, 442
Rhododendron Fragrantissimum, by R. D. Trotter, **154**, 156, 242, 442
"Rhododendrons," by F. Kingdon-Ward, reviewed, 80
Rhododendrons and Azaleas, Bud Blast on, 230, **237**

Rhodohypoxis Baurii, exhb., lxxx, 174, 221, 440
Rhodostachys andina, 283
bicolor, 282
pitcairniifolia, 283
Rhubarb Early Superb, H.C.* 1949...42
Giant Crimson Grooveless, A.M.* 1949...43
Hawke's Champagne, F.C.C.* 1949, 42
Macdonald, **A.M.*** 1949...42
The Sutton, exhb., lxxxvi
Timperley Early H.C.* 1949...42
Unknown, exhb., lxxxvi
Valentine, **H.C.*** 1949...42
Rhubarb at Wisley, 1949...42
Rhus copallina, 376
Cotinus (The Smoke Tree), 15, 376
Toxicodendron, 376
Riall, Col., Mrs. and Miss, 244, 245, 322
Ribes laurifolia, 320
petraeum, 432
rubrum, 432
vulgare, 432
Richter, W., "Anzucht und Kultur der Bromeliaceen mit besonderer Berücksichtigung der fur den Handel wichtigsten Arten," reviewed, 457
Riemschneider, R., "Zur Kenntnis der Kontakt-Insektizide II," reviewed, 458
Robertson, Daniel, 243
Robinson, G. W., on Some Chilean Plants cultivated in Britain, 161, 202, 360
"Rock Garden and Pool, The A.B.C. of the," by W. E. Shewell-Cooper, reviewed, 492
Rockley, Lady, 187
Rodgersia pinnata, 328
superba, 237
podophylla, 441
tabularis, 239
Roger-Smith, Dr. Hugh on, "Plant Hunting in Europe," reviewed, 336
Romneya Coulteri (Californian Poppy), 15, 405
hybrida (R. Coulteri × R. trichocalyx), 15, 405
trichocalyx, 15, 260, 398
Rosa alba, 9
altaica, 7
anemonoides Ramona, A.M. May 23, 1950, exhb., lxxxvii, 397, 412
bracteata, 245
canina, 7, 357
Andersonii, 7
Cantabrigiensis, 7
chinensis, 10
Davidii, 7
dianthiflora, 320
Ecae, 320
Eglanteria, 7
Farreri, The Threepenny-bit Rose, 7, 320
persetosa, 7
foetida (R. lutea), 8, 9
var. persiana, exhb., xciii
highdownensis, 7, 234
Hillieri, 7, 320
Rosa Hugonis, 6, 7
longicuspis, exhb., xcvi
macrantha, 8
macrantha hybrid Raubritter, 8
macrophylla, 307
mirifica, 320
moschata flore semi-pleno, exhb., civ
Moyesii, 6, 17, 234, 321
Geranium, **A.M.** Aug. 29, 1950, exhb., vii, 7, 490, cv
× La Giralda, 10
× macrophylla, exhb., vii
mutabilis, 11
nutkana, 233
odorata gigantea, 242
omeiensis lutea, exhb., lxxxi
Paulii rosea, 8, 26
(R. rugosa repens alba), 8
pendulina, 234
pomifera, 7, 234
Richardii (R. sancta), 8
rosea, 8
rubiginosa, 7
rubra (or atropurpurea), 9
rubrifolia, A.M. Sept. 20, 1949, exhb. vii, 44
rugosa, 9, 10
× arvensis, 8
× bracteata (Mermaid's Parent), 10
scabrosa, 9
sericea, 307
setipoda, 7, 234
Slingeri, 320
Soulieana, 8
spinosissima, 7, 8, 10
hybrid Fruhlingsgold, **A.M.** May 23, 1950, exhb., lxxxvii, **397, 413**
Sweginzowii, 7, cv
turkestanica, 11
virginiana (R. lucida), 8
Wardii, 7
xanthina, 7, 320
Canary Bird, 7
spontanea, 7
Rosa Species and Hybrids at Wisley, Notes on the, by Rona Hurst, 232
Roscoea alpina, 154
August Beauty, 230
cautleoides (Bee's Dwarf), 174, 229, 230, 316
Humeana, 174, 229
purpurea, 154
Rose Agnes (Rosa rugosa × Persian Yellow), xcvi, 10
Alister Gray, 11
Stella Gray, 11
Armagh, exhb., lxxxvi
Austrian Briar, 8
Copper, 9
Belle Poitevine, 9
Betty Uprichard, 107
Blanc double de Coubert, 9
Bourbon, Commandant Beaurepaire, 11
Honorine de Brabant, 11
Mme. Pierre Oger, 11
Reine Victoria, 11
Souv de la Malmaison, 320

Rose Cantab, 233, 234
Cabbage Tour de Malakoff, 219
Capt. Hayward, 108
Caroline Testout, 107
Cecile Brunner, 11
Major, 11
Celestial, 245
China and Tea hybrids, 12
Claude, **A.M.** June 27, 1950, exhb., xcv, 412
Conrad F. Meyer, 9
Cornelia, 11
Dainty Bess, 107, **111**
Danae, 11
Damask Mme. Hardy, 219
d'Amour (R. virginiana plena), 320
Delicata, 9
Dog, 7
Donald Prior, exhb., lxxx
Eden Rose, **A.M.** July 11, 1950, exhb., xcv, xcviii, 412
Edouard Renard, 108
Étoile de Hollande, 108
Fanny Blankers Koen, exhb., lxxxvi
Felicia, 11
Frau Dagmar, 9
Dagmar Hartopp, 9
Karl Druschki, 10, 108
Fruhlingsgold, 10
Fruhlingsmorgen, 10
Fruhlingszauber, 10
Gallica Cardinal de Richelieu, 219, 245
Hippolyte, 219
Tuscany, 219
General McArthur, 107
Grandmère Jenny, exhb., ii, xcv
Hector Deane, 108
Hiawatha sport, exhb., xcvi
Hugh Dickson, 108, **116**
Hybrid Musk, Penelope, 11, 241
Polyantha No. 38–47, **P.C.** May 23, 1950, exhb., lxxxvi
Tea, Dainty Bess, 300
Dorothy Anderson, **P.C.** May 23, 1950, exhb., lxxxvi
John H. Ellis, **P.C.** May 23, 1950, exhb., lxxxvi
L'Innocence, 300
Japanese Rugosas, The, 7
Karl Foerster, 10
Koenigin von Danemarck, 245
Lady Curzon, 8
Hillingdon, 108
Sylvia, 108
La Giralda, 17
l'Espérance, 320
Lucie Marie, 108
Maiden's Blush, 245
Mary, exhb., lxxxvi
Mermaid, 258
Monique, **A.M.** June 27, 1950, exhb., xcv, 412
Moonbeam, **A.M.** July 11, 1950, exhb., xcviii, 413
Moss, 12
Blanche Moreau, 219
Mrs. Anthony Waterer, 9
John Laing, 108
Rose Mrs. Oakley Fisher, 241, 242
Nevada, 10, 17
Noisette Champney's Pink Cluster, 318
Nova Zembla, 9
No. 555, exhb., lxxxvi
Nur Mahal, 11
Ophelia, 108
Parfum de l'Hay, 9
Persian Yellow, 9
Pompon Beauty, exhb., lxxxvi
President Hoover, 108
Prosperity, 11
Red Letter Day, 108, 233
Rose d'Amour, 8
Roseraie de l'Hay, 9
Rubaiyat, exhb., lxxxvi
Rustica, 9
Sarah Van Fleet, 9
Schneezwerg, 10
Souv. de Jac Verschuren, exhb., lxxxvi
Maxime Cornu, 320
St. Annes, 320
Stanwell Perpetual, 10
Sultane, **A.M.** June 27, 1950, exhb., xcv, 413
Tapis Rose, exhb., vii
Thisbe, 11
Tipo Ideale, 11
Ulrich Brunner, 108
Ulster Monarch, exhb., lxxxvi
Vanity, 11
Wedding Day (R. Sinowilsoni × R. Moyesii selfed), **A.M.** June 13, 1950, exhb., xcii, 413
Wilhelm, 11
Wolley Dod's, 7
Yellow Cluster, exhb., lxxxvi
Yves Laticulle, **A.M.** July 11, 1950, xcviii, 413
"Roses," by Bertram Park, O.B.E., reviewed, 139
Roses as Flowering Shrubs, by J. Wilson, 107
"Roses of Southern Gardens," by Bessie Mary Bird, reviewed, 216
Roses, Old fashioned, 11, **26**
Roses, Shrub, by G. S. Thomas, 6
Rosmarina officinalis, 450
Rowley, Gordon, on Rhinephyllum Broomii L. Bolus, 487
Rubus tricolor, 441
Rudbeckia speciosa, 340
Sullivantii Goldsturn, exhb., selected for trial, cii
Ruscus aculeatus, 451
Russell, James, 316, 317
Rust Disease of Antirrhinum (Puccinia antirrhini), 117
Disease of Begonia, 69
Ruta graveolens Jackman's Blue, exhb., xxxviii

Sage, Common, 195
Salix alba argentea, 318
vitellina pendula, 376
britzenais, 58
daphnoides, 59, **66**
Fargesii, 319

Salix purpurea, 59
vitellina, 58
Salmon, Mr. and Mrs. George, 247
Salpiglossis sp. from Chile, 161, 162
Salvia ambigens (coerulea), 210, 300
azurea, exhb., xxxvi
coerulea, 195, 210, 340
gesneraeflora, **A.M.** March 7, 1950, exhb., lxiii, 335
Grahami, 194, 195, 196
Greggii, 194, 316
lavandulifolia, 195, 452
officinalis, 195
rutilans, 195
sclarea var. turkestanica, 194
Seedling, exhb., xcviii
splendens Wisley tetraploid, exhb., vii
uliginosa, 340
virgata, 194
Sambucus canadensis var. maxima, 15
nigra var. alba, ix
Samolus Valerandi, 451
Sander, David F., Orchids for the Weekend Gardener, 269
Sands, Mollie, "The Gardens of Hampton Court," reviewed, 460
Sanguinaria canadensis flore plena, 150
Canadian Blood Root, 150
Santolina Chamaecyparissus, 320
Sarcocapnos crassifolia var. speciosa, 449
enneaphylla, 445, 449
Sarcococca Hookeriana, var. digyna, 55
humilis, 149
Sarmienta repens, 280
Satyrium nepalense, 314
Saussurea gossipiphora, 311, **317**
Stella, **B.C.**$_9$ exhb., c, ciii
Sawyer, Mairi T., on Inverewe. A Garden in the North West Highlands, 436
Saxegothea conspicua, 162
Saxifraga Burseriana, 55
Camposii, 449
cardiophylla, 230
cordifolia, 85
Cotyledon, 174
diversifolia, 230
Fortunei, 377, 424
gemmulosa, 481
Griesbachii, 55
lilacina, 230
longifolia Walpole's variety, 245
oppositifolia, 62, 86
pasumensis, 230
peltata, 144
Rigoi, 447, 449
umbellata, 230
Saxifrages, Kabschia, 62
Scabiosa caucasica var. Souter's Dinkie, exhb., selected for trial, ii
Market Favourite, exhb., selected for trial, ii
pulsatilloides, 479, 480
tomentosa, 447
Scarborough, Countess of, 195
"Scented Garden, The," by Eleanor Sinclair Rohde, reviewed, 49
Scented-Leaved Plants, some, by A. D. B. Wood, 192
Schima argentea, exhb., vii
Schima Khasiana, exhb., vii
Schizanthus pinnatus, 161, 251
Schizocodon alpinus, 151
macrophyllus, 151, **154**
soldanelloides, 151
Schizopetalon, Walkeri, 162, 164
Schizostylis coccinea, 340
Viscountess Byng, 443
Mrs. Hegarty, 443
"School Gardening in the Tropics," by R. O. Williams, reviewed, 215
Sciadopitys verticillata, xxxix, c, 265
Scilla bifolia, exhb., lxiv, 65
ciliaris, 328
sibirica, xxxvii, 116
Schizandra rubiflora, 318
Schizanthus sp. from Chile, 161, 162
Sclerotium tuliparum, 115
Scutellaria scordifolia, exhb., xciv
Scyphanthus elegans (syn. Grammatocarpus volubilis), 207
Sealy, J. R., 21
"Seasons Through, The," by Stuart Maddox Masters, reviewed, 52
Seaton & Gray, Messrs., 290, 291
Secretary's Page, The, 1, 53, 81, 141, 169, 217, 257, 297, 337, 373, 421, 461
Secrett, F. A., C.B.E., F.L.S., V.M.H., on Present-Day Problems of the Horticultural Industry, 175
Secrett, F. A., Horticultural holding at Milford, **192**
Sedum cauticolum, 423
Hobsonii, 230
primuloides, 230
spectabile, 340
trifidum, 230
"Selected Works: I. V. Michurin," reviewed, 369
Sempervivum arachnoideum var. Laggeri, **A.M.** June 27, 1950, exhb., xcvii, 415
octopodes apetalous, exhb., xciv
apetalum, exhb., xcvii
Senecio chilensis, 248
Cineraria, 320
doronicifolius, 320
Greyi, 15
laxifolius, 15, 219, 320, 340
Smithii, 248
uniflorus, exhb., lxxix
Sharma and Dhwoj, collectors in Nepal 302, 310
Sheath, W. W., 69
Sherriff, Major George and Mrs., 190, 227, 230
Shilson, Mr., 330
Shortia galacifolia, 144, 150
uniflora grandiflora, 144, 150
Shows, Opening of, 142
Shrub Roses by G. S. Thomas, 6
Shrubs, Awards to, in 1949—43
Shrubs, Summer and Autumn flowering by F. P. Knight, 12
Sisyrinchium chilense, 284
convolutum, 284
cuspidatum, 284
graminifolium, 284
junceum, 284
maculatum, 284

Sisyrinchium roseum, 284
sp. in Chile, 162
striatum, 284
Sitwell, Sir George, 197
"Skeptical Gardener, The," by Humphrey Denham, reviewed, 48
Skimmia japonica, 59
Slinger, Leslie, 239, 240
"Small Gardens, Herbs Grown on Town Window Ledges and in," by Maud Buckland, reviewed, 168
Smith, Sir William Wright, 76
Smith, Major Dorrien, 283
Smith, Lt.-Col., 240
Smith, Dr. Floyd, 69
Smith, F. F., 74
Smith, Kenneth M., D.Sc., F.R.S., on Some New Virus Diseases of Ornamental Plants, 350
Smith, Martin R., 344
Smith, T., 188
Snowden, J. D., 23
"Snowdonia, The National Park of Wales," by F. J. North, B. Campbell and R. Scott, reviewed, 420
"Soil, The Living," by E. B. Balfour, reviewed, 138
Solanum crispum, 438
autumnale, 242, 250
Glasnevin form, 15, 241, 250
demissum, 472
jasminoides, 260, 287, 316, 339, 377
nigrum, **441**
pinnatum, 251
tuberosum, 472
valdiviense, 251
Soldanella montana, 144
pusilla, 150
Solenomelus chilensis, 284
Sophora tetraptera, 203, 329, 356
viciifolia, 12, 219
Sophrolaeliocattleya Trizac var. Purple Queen (C. Trianae × Slc. Anzac), **A.M.** March 21, 1950, exhb., lxv, 294
Sorbus Folgneri, 321
foliolosa, 155
Thompsonii, 246
Vilmorinii, 246, 441
"South America Called Them," by Victor W. van Hagen, reviewed, 456
"Soviet Genetics and World Science," by Julian Huxley, reviewed, 370
Spartium junceum (Spanish Broom), 13, 220
Spathodea campanulata, 358
Spathoglottis Dwarf Legion var. Sunrise, **355**
Spencer, Edmund, 319
Spergula rupestris, 420
Sphacele campanulata, 282
Sphaeralcea Fendleri, 339
Spiraea arborea, 13, 301
ariaefolia, 16
bella, 307
canescens, 308
discolor, 16, 210
japonica, 13
var. Anthony Waterer, 17
Lindleyana, 16, 27
Spiraea sorbifolia, 16
Spitta, M. W., on Amateur Plant Hunting in the Andes, 354
Sprengel, Kurt, 403
Squalermo, Luigi, 476
Squires, Dennis, 281
Stachys lanata, 259
Stachyurus praecox, 56
Stackhouse, Rev. William, 327
Stanford, Miss, 325
Staphylea colchica, exhb., lxxxvii
holocarpa rosea, 321
Statice latifolia var. Chilwell Beauty, exhb., ii
Stauntoria hexaphylla, 320
Stead, Archdeacon, 329
Stearn William T., on Lilium Sherriffiae, A new Himalayan Lily, 190
on Nepeta Mussinii and N. × Faassenii, 403
Stearn, William T., and H. Drysdale Woodcock, on "Lilies of the World," reviewed 367
Stebbins, J. L., Jnr., 110
Stenandrium dulce, 281
Stephanotis floribunda, exhb., lxx
Stern, F. C., F.L.S., V.M.H., 24, 64, 108, 160, 234, 302
on Calceolaria Darwinii, 106
on Iris Histrio var. aintabensis, 157
on Mahonia lomariifolia, 157
Sternbergia lutea, 377, 423
Stewartia Malacodendron, 13, **27**
Stiff, Mrs., 325
Stipa pinnata, 246
St. Lawrence, T. J. Gaisford, 316
Stoughton, R. H., 110
Stranvaesia Vilmoriniana, 318
Strawbery Auchincruive Climax, **F.C.C.**, June 27, 1950, xciv
Cambridge Seedling No. 365, exhb., xcv
Nos. 54, 448, 456, 503, 641, xcv
Royal Sovereign Pinetree Strain, exhb., lxxv, lxxix
with reddish petals, exhb., xciv
Streeter, F., V.M.H., on Cyclamen persicum, 185
Strelitzia Reginae, 4
Strobilanthes oresbius, 89
Struthiopteris germanica, 442
Styrax japonica, 220, 321
Obassia, 318
philadelphoides, exhb., xcix
Sweet Pea Albatross, **H.C.*** June 12, 1950...408
Betty, **A.M.*** June 24, 1949...27, 35
Blue Cloud, **A.M.*** June 12, 1950, 408
Bright Eye, **H.C.*** June 12, 1950, 408
Calcot, **A.M.*** June 12, 1950...408
Country Girl, **A.M.*** June 12, 1950, 408
Crimson Excelsior, **A.M.*** June 24, 1949...27, 35
Delight, **H.C.*** June 12, 1950...409
Friendship, **H.C.*** June 24, 1949, 36

Sweet Pea Glow, **H.C.*** June 24, 1949...36
Gold Jubilee, **A.M.*** June 24, 1949, **27**, 35
Highland Mist, **A.M.*** June 24, 1949, **27**, 35
Lavender Bonnet, **H.C.*** June 24, 1949...36
Lime Light, **H.C.*** June 24, 1949...36
Maid of Honour, **H.C.*** June 24, 1949...36
Maiden's Blush, **H.C.*** June 12, 1950, 408
Matador, **A.M.*** June 12, 1950...409
My Love, **H.C.*** June 24, 1949...36
Peggy Edwards, **A.M.*** June 24, 1949...**27**, 35
Robert, **A.M.*** June 12, 1950...408
Shirley Pink, **H.C.*** June 24, 1949, 36
Stylish, **H.C.*** June 24, 1949...36
Sultan, 61
Tips, **H.C.*** June 24, 1949...36
Vanity, **A.M.*** June 12, 1950...408
Sweet Peas tried at Goring-by-Sea, Sussex, 1949...35
Swertia speciosa, 154
Swiss Alpine Flowers, by Walter Rytz-Miller, reviewed, 51
Sycopsis sinensis, 150
Symphoricarpus albus laevigatus, 423
Symphyostemon odoratissimus, 284
Synchytrium endobioticum, 472
Synge, Patrick, M., on The Garden in Winter, 57
Syringa massena, exhb., lxxxvii
var. exhb., lxxxvii
vulgaris Primrose, **A.M.** May 23, 1950, exhb., lxxxvii, 413

Taeniothrips simplex, 375
Tamarix pentandra, 19
rubra, 19
Tamblyn, Fred, 329
Tapeinochilus ananassae, exhb., c
Tarsonemus latus, 70
pallidus (Cyclamen Mite), 72
translucens (Green), 70
Taylor, George, D.Sc., 192, 230, 315
Notes on a few plants from S.E. Tibet, 87, 90
Taylor, G. M., on Show Auriculas. The edged varieties of the florists, 386
Taylor, H. V., C.B.E., D.Sc., V.M.H., 175
Taxodium distichum, xxxix
Taxus baccata, 450
Baronii, 246
Tecophilaea cyanocrocus, 283, 402
Leichtlini, 283
violaeflora, 283
Telopea truncata, 329
Tetraclinis articulata, xxxix
Teucrium capitatum, 452
flavum, 480
latifolium, 440
pumilum, 485
rotundifolium (T. granatense), 447, 448
Thalictrum Chelidonii, 230, 307, 317
virgatum, 307
Thermopsis barbata, 307, **317**
Thomas, Dr. P. T., 465
Thomas, G. S., on Shrub Roses, 6
on Some Famous Irish Gardens, 315
Thomas, Rev. M. E., 3
Thompson, Mr., 160
Thuja gigantea, 437
plicata, 320
variegata (zebrina), 240
Thurston, Mr., 165
Thyme Funkii, 483
longiflorus, 483
var. ciliatus, 483
moroderi Martinez, 483
Thymelaea granatensis, 449
Thymus citriodorus, 194
granatensis var. longiflorus, 480
Tiarella trifoliata, 153
Tibet, Notes on a few plants from S.E., by George Taylor, D.Sc., 87
Tibouchina semi-decandra, 68, 301, 377, 423
Tilman, Maj. H. W., 302, 308, 315
"Tobacco Growing Allotment," by J. H. Burn-Murdoch, reviewed, 51
Tolmiea Menziesii, 153
"Tomato Diseases," by Robert McKay, reviewed, 460
Tomato Exhibition, 472
Tomato First-in-the-Field, 473
Harbinger, 472
Ivory White, exhb., vi
Puck, 473, 474
Stonor's Exhibition, 472
Victor, 473
Tomatoes, A physiological breakdown in, caused by high temperatures in 1949, by Robert McKay, 288
Trachelium coeruleum, 451, 482
Trachelospermum jasminoides, 329
Tradescantia Kreisler, selected for trial, vii
"Trees and Shrubs hardy in the British Isles," by W. J. Bean, C.V.O., I.S.O., V.M.H., reviewed, 366
"Trees have Names," by Adrian Hill, reviewed 214
Trevoa trinervis, 203
Trichinium Manglesii, 300, 339, 424
Trichosma suavis, 463
Trickett, R. S., on Nymphaea gigantea alba, 76
Tricuspidaria dependens, 166
lanceolata, 166, 438, 440
Tricyrtis formosana, 154
hirta, 154
pilosa, 154
Trillium cernuum, 151
erectum, exhb., lxx, 151
grandiflorum, exhb., lxx, 150
roseum, 151
ovatum, 150
sessile, 151
stylosum, 151
undulatum, 151
Tripterygium Forrestii, exhb., iii
Triptilion cordifolium, 248

Triptilion spinosum, 248
Triteleia conspicua, exhb., lxx
Trollius acaulis, 222
  pumilus, 222
  vaginatus, 222
Tropaeolum aduncum, 167
  azureum (violaeflorum), 167
  brachyceras, 167
  majus, 286
  mosaic, 352, 353
  polyphyllum, **155,** 166
    var. Leichtlinii, 166
  Ringspot, 352
  speciosum, v, **155,** 166, 239, 259, 438
Trotter, R. D., on Rhododendron Fragrantissimum, 156
Tsuga Brunoniana, 304
  canadensis Sargentii pendula, 246
  heterophylla, 321
  Mertensiana, 149
  Sieboldii, 321
Tubergen, Messrs. Van, 62
Tulip General de Wet, 431
  Grand Maître, 431
  Keizerskroon, 431
  King of the Blues, 431
  Lord Balfour, 431
    Derby, 431
  Massenet, 431
  Pink Beauty, 431
  Queen of the Pinks, 431
  White Streak of, 351
Tulip, Grey bulb rot of, by W. C. Moore, **111,** 113, 115
Tulipa Kaufmanniana, 86
  Sprengeri, 210
"Turf Cultivation, the Science of," by R. P. Faulkner, reviewed, 296
Tyerman, J., 330, 401

Ulmus nigra, 445
Uphof, Professor, J. C., 21
Urospermum Dalechampii, 244
Uvularia perfoliata, 151

Vaccinium canadensis, 155
  caespitosum, 155
  ciliatum, 155
  Delavayi, **A.M.** May 23, 1950, exhb., lxxix, xc, 238, 415
  glauco-album, 155
  hirtum Smalli, 155
  Nummularia, 152
  ovatum, 360
  padifolium, 154
  parvifolium, 155
Valleta purpurea, Scarborough Lily, 339
Vancouveria hexophylla, 328
Van Dijk, W., 23
Vanda, Miss Joaquim, 365
"Vegetable and Flower Growing," by Marion Huntbach, reviewed, 296
Vegetable Research, British Society for the Promotion of, 54
Vegetables, The Cooking of, by Monsieur J. Vincent, 346
Vegetables, The Profitable Culture of, xxiii
Veitch, Messrs., 162, 166, 247, 263, 266, 280, 281, 463
Veitch & Lobb, Messrs., 250
Vella spinosa, 479
Veltheimia viridifolia, exhb., lxiii
Verbascum Hervieri, 448, **478**
Verbena Aloysia, 281
  bonariensis, 259
  chamaedryfolia, 220, 300, 340, 377
  corymbosa, 281
  erinoides, 281
  Lawrence Johnston, exhb., lxxxiv, xci, 299
  Lippia citriodora, 281
  thymifolia, 281
  tridens, 281
Vernonia arkansana, exhb., iii
Veronica elliptica var. Autumn Glory, 18
  longifolia, 259
  speciosa, 19
  Spender's Seedling, exhb., xcvi
Verschuur, Jan, 22
Viburnum alnifolium, 377
  bitchiuense, 144, **193,** 211
  bodnantense, 60, **66**
  Burkwoodii, 144
  Carlesii, 144, 211
  Davidii, 240
  foetens, 5, 60
  foetidum rectangulatum, 377
  fragrans, 60
  grandiflorum, 5, 60, 319
  Juddii, 144
  Opulus aureum, 377
  tomentosum Lanarth variety, 246
    Mariesii, 239, 377
    Rowallane variety, 237
  utile, 144
Vincent, Monsieur J., on The Cooking of Vegetables, 346
Vines, Erinose on, xii
Viola Admiration, 397
  arborescens, 483
  Bridal Morn, 397
  cazorlensis, 449, 451, **478**
  Chantreyland, exhb., selected for trial, [cii
  Curtisii, exhb., xc
  Jackanapes, 397
  Kathleen, 397
  Maggie Mott, 397
  Moseley Perfection, 397
  Newton Mauve, 397
  Peacefold, 397
  Pickering Blue, 397
  Primrose Dame, 397
  Swan, 397
Violas by J. Wilson, 396, **397**
Virus Diseases, Some New, of Ornamental Plants, by Kenneth M. Smith, D.Sc., F.R.S., 350, **355**
Viscum cruciatum, 482
von Hagen, Victor W., "South America Called Them," reviewed, 456
Voorhelm Schneevoogt G., 23
Vuylstekeara Angela var. Jasper (Oda. Pittiae × Odtna. Milly), **A.M.** May 2, 1950, exhb., lxxxi, 294

Walker, Mr., 162
Wallace, Professor T., C.B.E., M.C., D.Sc., F.R.I.C., on The Production of Quality in Apples, 91
Wallflower, Rogue, xci
Wallich, Nathanael, 362
Walpole, E. H., 187, 245, 246
War Memorial at Wisley, 3, **26**
Warburton, J. W., 282
Warcollier, G., "The Principles and Practice of Cider-Making," reviewed, 460
"Watercress Cultivation of," reviewed, 215
Watercress, Parasite of, lxix
Waterlily Tulips, 86
Watson, Professor, J. S., 156
Watsonia Beatricis, **441**, 443
Webster, Mr., 244
"Weeds, Suppression of, by Fertilisers and Chemicals," by H. C. Long, and Winifred E. Brenchley, reviewed, 372
Weinmannia trichosperma, 241, 355
Wheelright, Richard, 286
White, C. T., 75, 288
"Wild Flowers in the Rockies," by George A. Hardy and Winifred V. Hardy, reviewed, 216
Wilks, Rev., 3
Williams, J. C., 86, 160, 327, 330
Williams, Percival Dacres, 327, 328, 329
Williams, R. O., O.B.E., on The White Bougainvillaea, 485
Willoughby, Adelaide C., "Orchids and How to Grow Them," reviewed, 490
Wilson, E. H., 208, 227, 237
Wilson, G. Fox, 263, 267
  on The Broad Mite, 69, 144
Wilson, J., on Roses as Flowering Shrubs, 107
  on Violas, 396
Wintersweet, Chimonanthus praecox var. luteus, 5
Winter Jasmine, 59
Wisley Gardens, 3, 54, 85, 143, 173, 210, 258, 299, 339, 376, **396**, 422, 463
  How to get there, 2
  Snow Damage at, lxxix
  Trials, 1948–1950...26, 78, 117, 331, 406
Wistaria multijuga, **237**, 242
Witch Hazels, 5, 59
Wolleston, Mr., 309, 311
Wood, A. D. B., on Some Scented-Leaved Plants, 192
Wood, W. P., "A Fuschia Survey," reviewed, 371
Woodall, Edward, 320
Woodcock, H. Drysdale and William T. Stearn on "Lilies of the World," reviewed, 367
Wormell, Rev. C. E., 3
Worsleya procera, **A.M.** Oct. 4, 1949...xi, **27**, 44
Worsleya procera, Further notes on, by Major Albert Pam, O.B.E., M.A., F.L.S., V.M.H., 20
Wright, C. H., 23
Wyatt, O. E. P., The Hybridizing of Lilies. An Amateur's Approach, 378

Yucca filamentosa, 19
  gloriosa, 19
  radiosa, **397**, 398
  recurvifolia, 19

Zauschneria californica, 300, 340
Zenobia pulverulenta, 14, 154
"Zur Kenntnis der Kontakt-Insektizide II," by R. Reimschneider, reviewed, 458
Zygopetalum Mackayi, 422

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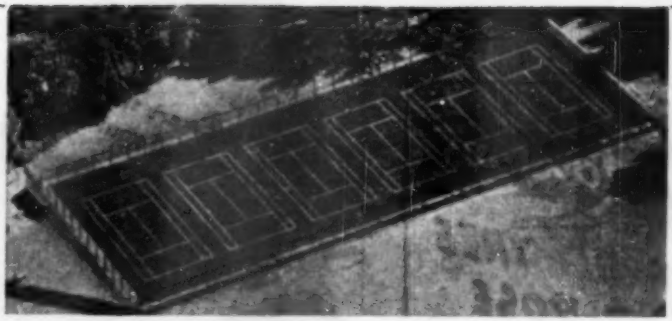

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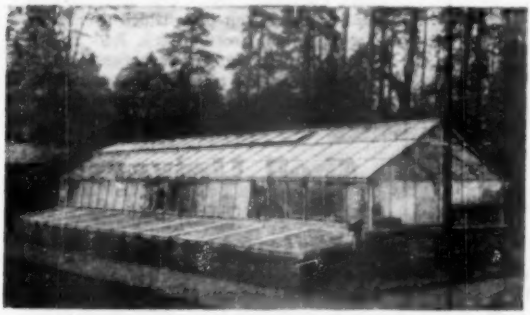

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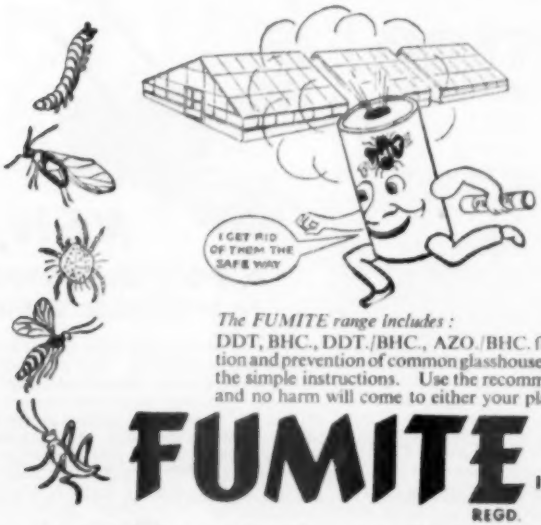

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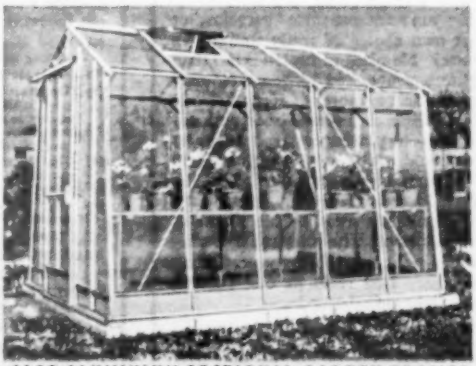

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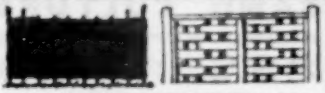

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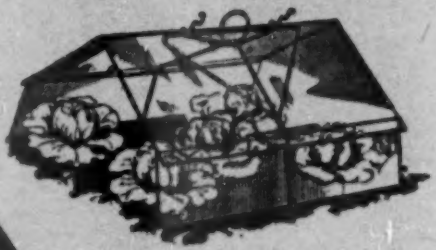

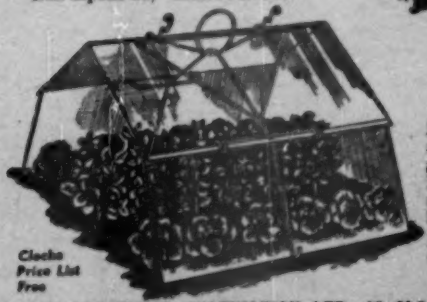

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